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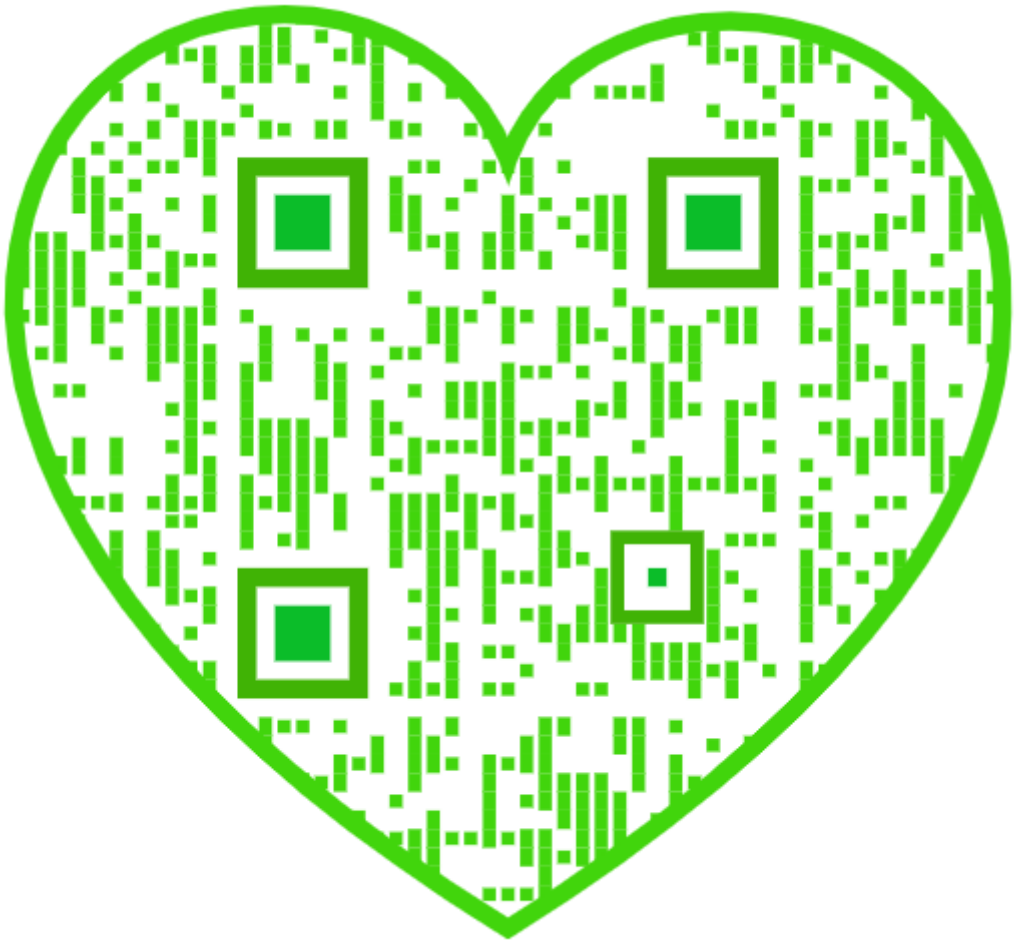

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SURGICAL DIAGNOSIS

By the same Author

DISEASES OF THE THYROID GLAND

AND THEIR SURGICAL TREATMENT

With 121 Illustrations

A MANUAL

OF

SURGICAL DIAGNOSIS

BY

JAMES BERRY, B.S., F.R.C.S.

SURGEON TO, AND LECTURER ON SURGERY AT, THE ROYAL FREE HOSPITAL,
FORMERLY SURGICAL REGISTRAR AND DEMONSTRATOR OF ANATOMY
OF OPERATIVE SURGERY AND OF PRACTICAL SURGERY
AT ST. BARTHOLOMEW'S HOSPITAL

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TO

SIR THOMAS SMITH, BART., K.C.V.O.

IN GRATEFUL AND AFFECTIONATE RECOGNITION

OF ALL THAT HE HAS TAUGHT ME

PREFACE.

This little book is intended mainly for dressers and junior practitioners, and is the outcome of more than twenty years of practical experience in the teaching of clinical surgery. Surgical diagnosis is so vast a subject, and so closely connected with pathology and other branches of surgery and medicine, that it is difficult to write of it as a separate entity. It is a subject with no beginning and no end, so intricate and far reaching are the questions involved in surgical diagnosis. It is hoped, however, that a book which does not attempt to deal fully with every detail of surgical diagnosis, but concerns itself rather with the principles involved and with the methods of examination that ought to be adopted in individual cases, may serve a useful purpose.

Throughout the book the attempt has been made to deal mainly with diseases and injuries that are common, and therefore of most importance to the student. I have endeavoured to lay stress upon what I have most often seen and experienced and believe to be of value, and have endeavoured to omit or to touch lightly upon what I have found to be uncommon.

I am aware that in doing this I shall be accused of having left out a good deal that I ought to have put in.

Doubtless there will be much truth in the accusation. I can only reply that I have tried to write down that which seemed to me to be of most importance.

To my friends Mr. E. W. Roughton and Dr. Florence Willey I am indebted for many valuable suggestions and for revision of the proof-sheets. I have also to thank Miss Lilian Naylor for the care with which she has prepared the index.

21 Wimpole Street, W.
April 1904.

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PART I.

SURGICAL DIAGNOSIS.

CHAPTER I.

INTRODUCTORY.

The art of surgical diagnosis consists in eliciting, by questions and by direct physical examination, as much information as possible about the case that is the object of diagnosis; in examining the information thus obtained; in reasoning upon it; and in deducing a correct conclusion therefrom.

In order that the conclusion or diagnosis be correct, it is desirable that the information obtained should be as full and complete as possible, and that the reasoning be correct.

It is obvious that the correctness of the diagnosis will depend:

i. Upon the fulness and the accuracy of the information obtained.

ii. Upon the experience and knowledge of surgery possessed by the surgeon, which enable him to reason correctly upon the information he has obtained.

Accurate information about the various points of the

case will not suffice for a correct and reliable diagnosis unless a knowledge of surgery, and especially of surgical pathology, as well as a certain amount of practical experience, be possessed by the diagnostician. On the other hand, it is essential that the premisses upon which the conclusion is based should be correct, if a correct interpretation is to be placed upon them.

Incorrect diagnosis may arise either from incomplete or inaccurate premisses, or from incorrect deduction therefrom.

Surgical diagnosis ought not to consist, as some students seem to imagine that it does, in the mere fitting of a name to a diseased condition. It should be much more than this. It should aim at ascertaining as exactly as possible in what respect, and to what extent, the patient's condition deviates from that of perfect health. In other words, it should comprise, not only the nomenclature of the disease, but also the degree and extent of that disease.

The diagnostician has two main sources of information upon which to found his diagnosis.

He ascertains from the patient, or from others, the **history** of the various ailments or symptoms which have been noticed. He ascertains, by direct **physical examination,** to what extent the condition of the body before him differs from the normal condition of a body of the same age and sex.

By putting together all the pieces of information obtained from these two sources, by reasoning about them and by exercising his judgment, he endeavours to arrive, if possible, at a diagnosis of the diseased condition.

Sometimes the one and sometimes the other of these two main sources of information is the more important. As a rule neither should be completely ignored.

Thus, in the case of an otherwise healthy person who has a large, soft, lobulated tumour in the subcutaneous tissue over the shoulder, the physical characters alone are usually sufficient for a diagnosis of fatty tumour. The history is comparatively unimportant, and would probably merely refer to the duration of the tumour and to any other ailments of which the patient may also be the subject.

Conversely, a history of repeated severe attacks of excruciating pain in the area of distribution of some portion of the fifth nerve may be sufficient for the diagnosis of epileptiform neuralgia, even though the patient may present no physical sign of disease.

Much caution should, however, be exercised before making a diagnosis upon history alone. Physical signs of disease which the surgeon can himself observe are as a rule much more important to him than mere history, for which he has to depend upon what is told him by others.

If history and physical examination appear to be contradictory, more stress should, as a rule, be laid upon the latter than upon the former.

Importance of Care and Thoroughness in Conducting the Examination.

The examination, both oral and physical, should be conducted carefully, and should be as thorough as circumstances allow.

It is all very well for a surgeon of considerable age

and vast experience to glance at a patient, just lay his hands on the affected part, perhaps ask one or two questions, and then deliver himself of a diagnosis. For such surgeons this book is not intended, although even such as they will sometimes make mistakes if they practise too frequently such rapid and cursory examinations. For the less experienced practitioner it cannot too earnestly be laid down that care and thoroughness in examination are all important. "Snap-shot" diagnoses, although sometimes impressive to the onlooker, carry with them the risk of serious error, and are not to be recommended. More mistakes in surgical diagnosis have arisen from carelessness and over confidence than from actual want of knowledge on the part of the surgeon.

In conducting his examination of the patient the surgeon should not confine his attention exclusively to that particular part of the body of which the patient complains. Although this is the part which first and chiefly engages his attention, he should not omit to examine other parts as well. If the affection is a unilateral one, he should carefully examine the corresponding part on the opposite side of the body, comparing it with the affected region.

If the case be an obscure one, a very thorough and minute examination of many parts may become necessary.

It should not be forgotten that a patient may be suffering simultaneously from two or more diseases. The one which is most obvious and most easily discovered is by no means necessarily the most important.

Thus a patient may present himself with the symptom of piles, but have also a carcinomatous

stricture of the rectum. A woman with a femoral hernia may be suffering from internal strangulation of some other portion of the bowel.

A patient with an adenoma of the breast may have enlarged axillary glands due to old tuberculous or other disease, and so on.

"Have you, or have you ever had, anything else the matter with you?" is a useful question, the answer to which may perhaps, by revealing some obscure or unnoticed feature in the condition of the patient or in the history of the case, throw an entirely new light upon the problem of diagnosis, and may be of the utmost importance.

This question is often useful when the investigator begins to feel that he is being puzzled by the case, or is uncertain as to its exact nature.

A patient was admitted into hospital on account of a chronic ulcer of the leg. The dresser made excellent notes about the ulcer, but found himself wholly unable to give any diagnosis as to its nature, since the diagnostic features of the ulcer were not in themselves sufficiently characteristic. A more complete examination revealed, on the patient's back, a circular, deeply excavated ulcer; there were also, in various other parts of the body, round depressed scars of healed ulcers. Also careful examination of the pupils showed considerable irregularity in one of them, and betokened a former attack of iritis.

It was then clear that the patient was suffering from tertiary syphilis, and much light was thrown upon the nature of the ulcer of the leg.

A boy was admitted on account of a swelling of one knee-joint, which had supervened, apparently spontaneously, a few days previously. It was obvious that the joint was full of fluid, but the nature of the fluid was not

apparent until cross-examination elicited the information that on several previous occasions he had bled severely after the extraction of teeth, that he had also suffered from hæmorrhage from the rectum and that other members of his family had also shown a marked tendency to hæmorrhage. The swelling of the knee-joint was thus suspected to be due to hæmophilia, and closer examination of the joint showed a very slight discoloration, which confirmed the diagnosis.

Excessive Examination.

In the case of patients who are acutely ill, prolonged and thorough examinations are often inadvisable. However desirable from the point of view of exact diagnosis, they may cause much distress and even harm to the patient, from exposure, pain, or fatigue.

It may be better to remain in ignorance about certain points necessary for a complete diagnosis, rather than run the risk of doing harm to the patient by thorough investigation of these points.

Unless some important point of treatment depends upon the exactness of the diagnosis, it is often better, at any rate for the time, to defer making that thorough examination without which complete diagnosis may be impossible.

Probability as an Element in Diagnosis.

Students often show a tendency to diagnose rarities of which they have read in books, but which they have never actually seen. The experienced practitioner will hesitate to do so until he has fully considered the possibility of the existence of some commoner affection.

This is frequently shown, for example, in the diag-

nosis between chronic inflammatory affections of bone, which are common, and malignant tumours of the same part, which are distinctly less common.

The diagnosis of a rare disease should not be made unless its features are characteristic and unmistakable, or until the possibility of its being some more common disease has been carefully considered and excluded.

If an example of some rare disease has recently been under his observation, the surgeon, when he meets with a second case of apparently similar nature, should be on his guard against jumping hurriedly to the conclusion that this also is an example of the same disease. It is probable that it will not be the same disease, and he should examine most carefully before pronouncing it to be of the same rare nature as the first.

The *age* and *sex* of the patient are important elements in this question of probability.

A disease that is common in the male subject may be rare in the female, and *vice versa*. Thus the symptoms of perforative peritonitis at the upper part of the abdomen in the case of an anæmic young woman are very suggestive of a perforated gastric ulcer. Similar symptoms in a young man would be more likely to indicate a perforated duodenal ulcer.

A disease that is frequently seen in the young may be uncommon or unknown in an older person, and *vice versa*. Thus, a history of frequent slight hæmorrhage from the rectum in the case of a young child would suggest a polypus; the same symptom in an adult would be more likely to indicate piles, or some form of ulceration of the rectum.

Chronic and severe intestinal obstruction for which no definite cause can be discovered is exceedingly likely

to be due, in the case of an elderly person, to a carcinomatous tumour of the large intestine. In the case of a child, such a diagnosis would be in the highest degree improbable, whereas bands of adhesion, due to some old inflammatory trouble, or some congenital affection, would be a much more likely cause.

The surgeon should always endeavour to make his **diagnosis as complete as possible.** Sometimes, however, a complete diagnosis may, owing to lack of sufficient evidence, be impossible. In such a case the surgeon may be able to make a partial diagnosis. He should always aim at making his diagnosis as accurate and complete as he can.

Diagnosis is usually but the first step towards prognosis and treatment. Sometimes these latter may be sufficiently evident even in the absence of the former in its complete form.

Thus, a patient may be suffering from acute symptoms of severe intestinal obstruction, which may obviously demand the surgical operation of abdominal section, although the precise nature of the obstruction may be problematical until the abdomen has been opened.

The diagnosis of a tumour (using the word in its widest sense of a swelling) generally involves an answer to two distinct questions.

1. **Where is the lump ?**—*i.e.*, in what anatomical structure is it situated ?

2. **What is the lump ?**—*i.e.*, what is its exact nature, is it inflammatory, new growth, &c. ?

Frequently the answer to one of these questions may easily and readily be given, while the answer to the other is difficult or impossible.

For instance, a small hard lump in the region of one

lobe of the thyroid gland, and moving freely with the larynx and trachea, may without much fear of error be pronounced to be a swelling of the thyroid gland. It may, nevertheless, be a matter of considerable difficulty to decide whether this is a solid adenoma, a tense cyst, or a malignant tumour in an early stage.

A swelling in the scrotum may obviously be of the testis, but it may be very difficult or impossible to pronounce definitely whether it is inflammatory or malignant.

Conversely, a pulsating swelling deeply seated at the root of the neck and behind the sternum may obviously be an aneurism, and yet it may be very difficult or impossible to say whether it springs from the arch of the aorta or from the innominate artery.

A hard and somewhat nodular tumour deeply seated in the abdomen of an elderly patient who had recently lost much weight and strength without apparent cause may be clearly malignant, while the exact anatomical situation of the growth may be a matter of much doubt.

Diagnosis by Exclusion.

In a difficult case in which the history and physical signs do not point clearly to a definite diagnosis, the surgeon may find it useful to endeavour to make a diagnosis by the method of exclusion. He passes rapidly before his mind all the possible diseases, or groups of diseases, of which the case before him may be an example. By eliminating first one then another and so on, he gradually narrows the field of diagnosis more and more until eventually he may be able to

arrive at a conclusion as to the true nature of the affection before him.

By this method he is less likely to overlook some possible diagnosis which had perhaps not hitherto occurred to his mind.

In proceeding to make a diagnosis by exclusion, some such classification of diseases as the following may be found useful. It may be modified, extended or altered according to individual taste :

1. Congenital malformations.
2. Atrophy.
3. Hypertrophy.
4. Inflammation.
   - (*a*) Acute.
   - (*b*) Chronic.
   - (*c*) Due to specific processes—*e.g.*, tubercle, syphilis, rheumatism.
   - (*d*) Results of inflammation—*e.g.*, abscess, ulcer, scar, &c.
5. Extravasations—*e.g.*, of blood.
   Accumulations—*e.g.*, of fluids in ducts or closed cavities.
   Concretions—*e.g.*, calculi, fæcal concretions, &c.
6. Parasites—*e.g.*, hydatids.
7. New growths—Innocent { Cystic. Solid.
   Malignant { Cystic. Solid.
8. Deformities—*e.g.*, lateral curvature of spine.
9. Nervous and hysterical affections.

[10. Injuries.]

Revision of the Diagnosis.

When the whole examination of the case has been finished, and a diagnosis, more or less complete, has been made, it is often well to review once more all the facts that have been elicited, and to ask oneself the question :

"Now, can this be anything else?" or, "Supposing this were not what I believe it to be, what other diagnosis might possibly be made?"

By exercising this wholesome mental effort, a mistake in diagnosis may sometimes, even at the last moment, be avoided. Something else may occur to the mind which, upon further consideration, may possibly lead to an alteration in the diagnosis.

A too hasty conclusion may perhaps have been drawn, and may require revision.

CHAPTER II.

SURGICAL "HISTORY" AND HOW IT SHOULD BE TAKEN.

UNDER the term "history" is included all the information that is obtained from the patient or his friends up to the time when the case comes under the notice of the surgeon. This naturally falls into three more or less distinct groups.

1. The **history** of the disease, illness, or injury from which the patient is at present suffering.
2. The **past history**, relating to any disease, illness, or injury antecedent to the commencement of the present trouble.
3. The **family history**, relating to diseases whether of a similar kind or not, that may have occurred in other members of the patient's family.

Each of these may be discussed separately. The first is usually by far the most important.

History of the present disease, illness or injury.—The surgeon has to ascertain and to arrange, as far as possible, in chronological order, all the symptoms and physical signs of which the patient has been the subject up to the present time.

The first question which should be put is, "**What is the matter with you?**" or, "**What is your complaint?**" The next question should usually be, "**How long have you had this trouble?**" (or these symptoms).

The duration, and consequently the rate of progress, of the disease being often a matter of great importance, the surgeon should first direct attention to the date of the beginning of the illness, and ascertain how the latter began. He should endeavour to get the patient to tell him what were the symptoms that he first noticed. Then, successively, the various steps in the progress of the disease should be ascertained, until he arrives at the present condition of the patient.

The surgeon should avoid asking leading questions, except when absolutely necessary. The patient should be induced, as far as possible, to tell his story in his own way, the surgeon merely directing his questions to the elicitation of particular points which may seem to have an important bearing upon the case.

Some patients are, however, very tiresome in the way they describe their symptoms. They often lay far too much stress upon unimportant details and envelop the really important facts in an irrelevant mass of verbal surplusage. This may arise from incompetence, from lack of intelligence or general education, from want of intelligent observation, and even sometimes from wilful misrepresentation.

Much care and attention may be required on the part of the surgeon to sift the grain from the chaff, to separate the really important points of the history from those which are trivial or irrelevant.

The state of the patient, again, may be such as to

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prevent him from giving any intelligible account of his symptoms. Information must then be sought from the patient's relations or friends, or others who have had opportunities of observing his symptoms. Especial attention should be paid to information communicated by a skilled observer, say a doctor or a nurse. The information communicated by unskilled observers should be received with a certain amount of caution. More attention should naturally be paid to facts observed by them than to any opinions that they may express.

The surgeon should also be on his guard against accepting too readily any diagnosis that may already have been made by other observers, whether skilled or not. It is well to receive with a certain amount of distrust any diagnosis which the patient himself may have made.

It should be remembered that the patient, especially if he belong to the better educated class, may have been reading about the disease from which he supposes himself to be suffering, and may perhaps glibly relate a long train of symptoms which have little or no real existence save in his own imagination. It is very easy for an excitable and nervous patient to believe that he (or she) really has the symptoms that he thinks he ought to have.

And this may occur without any idea or intention of wilful deception on the part of the patient.

The cautious and well-trained surgeon will endeavour to estimate from observation of the character of his informant the relative value of the statements made by him. Statements which appear to be wholly at variance with the facts observed by himself should be received with much caution. The history obtained from others

is the more valuable if it seems to be confirmed by what the surgeon can observe for himself.

In endeavouring to assign a date to the onset of a disease it must be remembered that a patient is apt to give the date at which he first noticed some prominent symptom, rather than the date at which the disease really began. Thus a patient presenting himself with an inflamed tumour may name some quite recent date as that of the origin of his trouble. The patient's answer may, however, really refer to the onset of the pain or the inflammation, rather than to that of the tumour itself.

In a case in which the patient's answer may seem to be open to misinterpretation, it may be well to put the question in another form, and to say, "How long is it since you were in perfectly good health in all respects?" or, "When was it that you first noticed anything at all the matter with you?"

In the investigation of the mode of origin of a swelling, or indeed of any affection, too much attention should not be paid to a history of injury unless this is definite and clear. For example, a patient will often attribute the origin of a tumour to some injury, real or imaginary, which may have had nothing whatever to do with its causation. The early stages in the growth of a tumour may entirely escape the patient's notice until some, perhaps slight, injury to the part draws the patient's attention to it, and a lump is discovered. Sometimes a definite injury to a pre-existing, although hitherto unnoticed, tumour may, by producing extravasation of blood, inflammation, or other secondary change, cause a rapid and obvious alteration in the characters of such a tumour.

In some cases the patient has already been subjected to treatment before he comes under observation. The surgeon will do well to bear this in mind, since information upon this point may be of value. A history of previous treatment, and the result obtained from it, may have considerable influence on the diagnosis. For example, in the case of a swelling of doubtful nature, a history that previous treatment of a similar swelling with large doses of iodide of potassium had resulted in a cure might point to a diagnosis of gumma. Recent treatment may also have masked the symptoms and may have led to erroneous conclusions unless the surgeon be aware of, and make allowance for, such treatment. For example, the previous administration of opium may diminish or conceal the symptoms of acute abdominal diseases.

Inequality of pupils in a cerebral case may lose much or all of its diagnostic value if a history of recent application of atropin to the eye be obtained. A question then which is often useful is, "Have you already had any treatment for this complaint? If so, what was the treatment, and what was the effect of it?"

The **past history** relates to any disease, illness, or injury antecedent to the present trouble. This is rarely of much importance in diagnosis, but may, nevertheless, in some cases afford an important clue, by suggesting a reason for existing symptoms.

Thus a history of an attack of some specific fever, such as enteric, may suggest a cause for an otherwise doubtful inflammatory swelling, say of the tibia, since it is well known that specific fevers are apt to leave behind them a tendency to sequelæ such as inflammatory affections of bone.

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A history of some previous tuberculous affection of a joint may suggest that the present trouble is likely also to be of a tuberculous nature, since a patient who has once suffered from tubercle is not unlikely to become affected at some subsequent period with some other manifestation of the same disease.

A history of a former operation upon the abdomen, such as ovariotomy, may, by suggesting intraperitoneal adhesions, afford a clue to the nature of an obscure case of intestinal obstruction.

The **occupation** and **habits of life** of the patient may also throw light upon the nature of the present trouble. It is hardly necessary to give examples to illustrate this, but the liability of drunkards to delirium tremens, of painters to wrist drop, of woolsorters to anthrax, of stablemen to glanders, are examples that readily occur to the mind. In each of these cases the habits of life or the occupation might in a doubtful case afford considerable help in the diagnosis of the above-named affections.

A history of residence in a foreign country, or in some locality where a certain disease is common, may be of importance, and suggest some disease that is unknown or uncommon in the place in which the patient comes under observation.

A boy presented himself with a paralysis of some of the muscles of one leg, at first suggesting infantile paralysis. The fact that he had lived for many years in the West Indies suggested the possibility of the paralysis being due to leprosy. This surmise was confirmed by the subsequent appearance of various characteristic lesions of the skin and mucous membranes.

A young man presented himself on account of slight

hæmaturia, which had been supposed to be due to stone. The history that he had recently spent several years in South Africa suggested a search for the ova of Bilharzia hæmatobia, and the discovery of numbers of these in the urine made the diagnosis clear.

A history of residence in a malarious district, or of a previous attack of malaria, may give a clue to the nature of an otherwise obscure elevation of temperature.

The **family history** is but rarely of any real importance in diagnosis. A few diseases, however, show a marked tendency to be transmitted from one generation to another, and a history of such a disease in a near relation may occasionally throw some light upon the problem of diagnosis.

Perhaps the best examples of hereditary transmission of disease are afforded by hæmophilia and colour-blindness. In the diagnosis of the former, family history is often of much importance.

Tubercle, again, is a disease that is often found to exist in many members of one family, and may to a certain extent be considered to be hereditary. At any rate a susceptibility to this disease may be hereditary.

It must not be forgotten, however, that, quite apart from heredity, various members of a family may become affected with the same disease, owing to some common influence to which they have all been exposed. Thus bronchocele, probably truly hereditary to a very small extent, is frequently seen to affect many members of one family and even generation after generation in the same family. The individuals, however, in these cases, will usually be found to have been exposed in early life to some common source of the

disease, having lived in a goitrous district and drunk goitriferous waters.

The various members of a family who have been brought up together, or in a similar manner, may show a tendency to develop similar diseases, such as rickets, due to improper feeding, and various affections due to want of exercise, bad ventilation, bad water supply, insanitary surroundings, &c.

In these cases, the family history of disease is due rather to community of surrounding influences than to a true hereditary tendency.

The less we know of the causes of disease the more likely are we to attribute to heredity what is really due to community of external causation.

Tumours, especially malignant tumours, are by some considered to be markedly hereditary, and it is often impossible to say whether the existence of tumours in two or more members of a family is to be attributed to heredity or to the common influence of some unknown cause. There is some evidence to show that the formation of certain tumours is connected with the locality in which these patients have lived.

A common popular notion exists that tumours are hereditary. It is not uncommon for a patient, upon being told that he or she has a cancer, to reply, "I cannot understand how that can be, for no member of my family has ever had cancer."

A hereditary history of cancer should have very little, if any, influence upon the diagnosis of a malignant tumour.

Indeed, family history affords but little help in the diagnosis of any disease, unless such history is very marked and clear.

CHAPTER III.

PHYSICAL EXAMINATION, AND HOW TO MAKE IT. METHODS OF EXAMINATION.

THE various methods that we employ in the physical examination of a patient may be grouped as follows:

I. Examination of the patient by the **unaided senses** of sight, touch, hearing, and occasionally smell.

II. Examination by various **instruments,** simple or complex, which aid these senses, or give us information upon special points.

III. Examination of **secretions, excretions,** and **discharges,** and of the **blood** of the patient.

IV. Examination by means of **anæsthetics and other drugs.**

V. **Operative procedures.**

Each of these groups may be discussed separately.

I. Examination of the patient by the unaided senses of sight, touch and hearing.

Inspection.—This should be general as well as local. The surgeon should notice any peculiarity of manner or disposition. He should examine the patient's face,

which may betray signs of ill health, or of intemperate habits, or give some other clue to the disease from which he is suffering.

The state of nutrition of the body should also be noticed; emaciation, obesity, muscularity, are points to which attention should be directed.

The condition of the skin and mucous membranes as regards pallor, congestion, sallowness, jaundice, bronzing, &c., should be noticed.

Care should be taken to place the patient as far as possible in a good light; and if artificial light is being used, allowance should be made for the yellowness of such a light.

If complaint be made of some local affection, the part affected should be inspected thoroughly and minutely, and from different points of view.

If necessary, many different parts of the body may have to be examined.

It is well to bear in mind the six principal systems of the body—digestive, respiratory, circulatory, nervous, locomotor, and genito-urinary. Attention should be paid to each of these, and a more or less thorough examination of each or all of them may be required.

Palpation should be performed with as much gentleness as possible, especially if the affected part be inflamed or tender.

As a rule, the whole hand should at first be laid upon the affected part. Large swellings especially should be examined in this way.

The common method of examining with the tips of the fingers is generally not so useful, unless the affected part be very small, or not accessible for examination with the hand.

Percussion is employed

i. To elicit tenderness, *e.g.*, in the examination of suspected caries of the spine, by tapping upon the vertebræ. Percussion of superficial bones, such as the tibia or skull, may reveal the existence of local tenderness, indicating inflammation.

ii. To detect the presence of gas or liquid in a cavity, *e.g.*, pleura, abdomen, &c., or of solid or liquid in a part that should normally be resonant, *e.g.*, parts of the chest or abdomen.

Mensuration, or measuring, is employed chiefly in the examination of the limbs, and in comparing one side of the body with the opposite one.*

It may be effected by the eye, by the hand, or by the measuring tape. The surgeon should accustom himself to use all three methods, and not to depend too much upon any one of them.

The shortening of the lower limb in cases of hip disease or fracture of the neck of the femur, the increase of circumferential measurement of the shoulder in cases of dislocation, are examples of the value of mensuration in diagnosis.

Auscultation is employed less by the surgeon than by the physician,† and its use is limited in the main to the examination of the thorax and abdomen.

It is also employed, however, in the examination of the various kinds of aneurism, and to detect friction of roughened or inflamed serous membranes upon each other.

* Mensuration of cavities, ducts, sinuses, &c., will be discussed under the head of Instruments (p. 26).

† A good surgeon does not neglect the art of medicine.

II. Instruments used for diagnosis.

These may be classified as follows: *

1. Instruments for aiding inspection.

2. Instruments for aiding palpation and mensuration.

3. Instruments for injecting or withdrawing fluids (insufflators, syringes, catheters, &c.).

4. Other instruments serving special purposes (thermometer, electric battery, &c.).

1. Instruments for aiding inspection are:

(1) **Simple magnifying lenses** used for the minute inspection of the skin in some skin diseases, the conjunctiva and other superficial parts.

(2) **Simple specula** (aural, nasal, vaginal, rectal, and urethral). These are employed in the examination of cavities not readily accessible to the unaided sight. Most of them serve the double purpose of reflecting light into the cavity and of retracting or separating its margins.

(3) **Reflectors** (with or without the addition of lenses) form an important group of instruments used for examining internal cavities (ophthalmoscope, otoscope, laryngoscope, cystoscope, urethroscope, œsophagoscope, &c.).

The simplest type of these is the laryngoscope.

A more complicated form is the ophthalmoscope, in which various lens are introduced. Still more complicated forms are those in which an electric light is carried on the instrument itself into the interior of the cavity that is to be examined (cystoscope, for example).

* The numerous instruments that are used in the chemical, microscopical, bacteriological, or other examinations of secretions, discharges, blood, &c., and are not applied directly to the patient, need not be described.

In certain cases use is made of **transmitted light**. The light thus used may be—

(a) Ordinary daylight.

(b) Artificial light from candle, lamp, &c.

(c) Light of Röntgen rays (X-rays).

(a) Ordinary daylight is used mainly inthe detection of clear fluid contained in a cavity near the surface and having a thin wall ; a hydrocele of the tunica vaginalis is the example that at once suggests itself.

(b) Examination by artificial light should be made in a darkened spot, and a hand placed vertically upon the part is usually sufficient to cut off the direct rays of light which otherwise might interfere with the inspection of transmitted light.

If a more accurate examination is required, it must be made in absolute darkness, and the transmitted light should be directed to the eye of the observer through a tube placed upon the part. An ordinary stethoscope or a roll of paper are the tubes usually employed for this purpose.

Sometimes an artificial (electric) light is introduced into the interior of the body (stomach, mouth), and the transmitted light is made to reveal diseases situated between the light and the eye of the observer.

These examinations must, of course, be conducted in an absolutely dark room. This method is of great valne in the examination of the sinuses about the face (antrum, frontal sinus).*

(c) Examination by X-rays.—Much use may be made of the important discovery of Prof. Röntgen that most parts of the body that are nearly or wholly opaque to ordinary light are nevertheless translucent as

* See chap. iv.

regards these remarkable rays, now usually known as X-rays.

Other parts of the body, however, and notably the bones, are opaque both to ordinary light and to the X-rays.

The rays in passing through the body cast shadows of the opaque parts through which they themselves cannot pass. These shadows may be rendered visible upon a fluorescent screen, or they may be directed upon a photographic plate, which is subsequently developed into a negative in the ordinary manner.

It is important to remember that the images thus obtained are not true pictorial representations, but are merely shadows.

Hence, if the opaque object is small, and at some distance from the plate, little or no distinct shadow may be cast. Small calculi in the kidney, for example, may give no appreciable shadow when looked for in this way.

Röntgen rays are of use in surgical diagnosis chiefly in connection with injuries and diseases of bones and joints, and in the detection of foreign bodies.

Considerable skill, however, is often necessary in the interpretation of the appearances seen in these photographs, and mistakes are not uncommon.

Large collections of blood, such as those in an aneurism, are tolerably opaque to the rays and may thus be rendered apparent.

Attempts have been made to render the shape and position of certain internal organs visible by putting metallic substances into them and then exposing to the X-rays.

Thus attempts have been made to render the shape

and situation of the stomach visible by placing within it an innocuous metallic salt, such as subnitrate of bismuth, which is opaque to the X-rays. But the information thus obtained is not very precise or reliable.

The exact situation of the opaque object (say, a foreign body in a limb) may be ascertained by examining in two directions, at right angles to each other, or by the employment of Mackenzie-Davidson's ingenious apparatus by which a stereoscopic picture is obtained.

2. **Instruments for aiding palpation and mensuration.**—For measuring the surface of the body which is readily accessible, the simple measuring tape is employed. If a very exact measurement of the shape of any part of the body be required, a cyrtometer is sometimes used. This consists simply of a flexible, non-elastic, metallic band, usually an alloy of lead, which can be moulded to the part, and which is sufficiently rigid to retain its shape after removal. Exact comparative measurements of the shape of the two sides of the thorax, abdomen, &c., are thus obtained. The degree of deformity of the spine in a case of caries may thus be recorded for comparison with similar measurements taken at some other stage of the disease. Casts in plaster of Paris, gutta percha, and other materials, as well as photographs, may be used for the similar purpose of making exact records.

The instruments that are chiefly employed in aiding palpation and mensuration are, however, those that are used in the examination of internal cavities which from their size or distance from the surface do not readily permit of direct examination with the finger.

Such instruments are probes, sounds, and bougies, all of which may be regarded in the light of a long and narrow finger, introduced into a sinus, duct or other cavity to determine its direction, size, shape, &c. The use of metal facilitates the detection of hard substances, such as dead bone at the bottom of a sinus or a calculus in the bladder or salivary duct.

The internal measurement of such cavities as the uterus or bladder is obtained by passing an instrument of this class. Occasionally a more complicated instrument may be used for an internal measurement, as when a lithotrite is introduced into the bladder to measure the size of a calculus.

3. **Instruments for injecting or withdrawing fluids.**—Air may be injected into the middle ear by means of a Eustachian catheter and Politzer's bag, in order to diagnose various diseases of the membrana tympani and middle ear.

The stomach and large intestine are occasionally filled with air by means of a tube and insufflator, in order to determine their exact situation and relations to surrounding parts. Water may be injected into the bladder or rectum to determine the capacity of these cavities.

Catheters and stomach tubes are used for withdrawing fluids from the bladder and stomach.

4. **Other instruments serving special purposes.**—Under this heading may be mentioned the thermometer, the stethoscope, the tuning-fork, and the sphymograph, the uses of which are obvious. The electric battery is, of course, of much use in the examination of the nervous and muscular system (as well as in the production of artificial light); two forms of current

are employed, the constant or galvanic and the interrupted or Faradic.

Before leaving the subject of instrumental examination it may be well to add that **much harm may be done to the patient** by the injudicious, careless, or improper use of instruments, especially by those which are introduced into the interior of the body.

Harm may be inflicted by

(i) Mechanical injury.

(ii) Introduction of septic matter.

(i) The perforation of the wall of a hollow viscus may easily be effected by the careless introduction of a rigid and pointed instrument. Perforation of the wall of the œsophagus, urethra, rectum or uterus by bougie or catheter are familiar examples. The bladder and large intestine may be ruptured from forcible over distension.

Laceration of the wall of the cavity may lead to hæmorrhage and inflammation, which in turn may set up very serious trouble.

All these accidents are naturally more likely to occur when the wall of the cavity has been softened and weakened by inflammation, ulceration, new growth or other disease. The healthy wall of a mucous cavity can scarcely be perforated or ruptured except by gross carelessness and the use of a quite unjustifiable degree of force.

Burning of the mucous membrane is not a very uncommon accident when an electric light is introduced into a mucous cavity and kept there too long (*e.g.*, in cystoscopy).*

* I have known a case in which a bad burn of the soft palate was

The prolonged application of X-rays, especially if the patient be under the influence of an anæsthetic, may produce a severe burn.

(ii) The introduction of septic matter frequently leads to the most dire consequences, in connection especially with the urinary organs. The harm that may be done by the introduction of a dirty catheter into the bladder is so well known that it need only be mentioned. The harm thus done is largely, but not wholly, avoidable, since a perfectly aseptic catheter may be rendered septic by its passage through the urethra. Not only should a catheter be rendered aseptic before introduction, but the urethra itself should as far as possible be cleansed (*a*) by making the patient pass water before the instrument is introduced, and (*b*) by washing the orifice of the urethra with some antiseptic lotion.*

III. **Examination of secretions, excretions, and discharges or of the blood.**

Secretions and excretions.

The chief points to which attention should be paid are the following:

Are they increased or diminished in amount? (*e.g.*, diminution of salivary secretion in obstruction of salivary duct, of urine in uræmia; increase of urine in diabetes).

Is there increase or diminution of any one or more of the normal constituents? (*e.g.*, decrease of urea in many kidney affections, of free hydrochloric acid in gastric

caused by the introduction of an over-heated laryngeal mirror. Cases of every one of the above-mentioned accidents have come under my own personal notice, chiefly during the periods in which I held the posts of house surgeon, house physician, and surgical registrar.

* And yet how often do we see these simple precautions neglected!

juice, in cancer of the stomach, increase of mucus in the urine in cystitis.)

Is any abnormal substance present? (*e.g.*, sugar, albumen, blood, or pus, in the urine of diabetes, nephritis, cancer of the bladder, or tuberculous pyelitis; blood, sarcinæ, or lactic acid in the vomited contents of the stomach, gallstones or undigested fat in the fæces, bits of villous growth, ova of Bilharzia hæmatobia, sand or gravel in the urine.)

The examination of secretions and excretions may be made with the naked eye, or may require more elaborate investigation in the laboratory by the aid of the microscope, chemistry, bacteriology, or even experimental injection into animals, as in the detection of tubercle, anthrax, &c.

Discharges from ulcers, sinuses on mucous or cutaneous surfaces, may require minute examination with reference to quantity, quality, presence of pus, blood, bacteria, as in tuberculosis; fungi, as in actinomycosis; epithelial or other cells, as in epithelioma, &c. For many of the preceding examinations the most elaborate appliances of the laboratory, too numerous for mention, may be required.

Examination of the Blood.

This is of more importance to the physician who has to deal with such diseases as chlorosis, leukæmia, malaria, and typhoid fever, than it is to the surgeon. The latter finds blood examination of value chiefly in the determination of deep-seated suppuration.

Examination of the blood from the surgical point of

view may be made to ascertain (i) the number of corpuscles (red and white) that are present in it; (ii) the existence and relative proportion of the different kinds of white corpuscles; (iii) the amount of hæmoglobin; (iv) the presence of micro-organisms.

(i) In endeavouring to estimate the **number of corpuscles** in the blood, the method is that of removing a drop of blood, diluting it, and then counting the actual number of corpuscles seen in a known volume of blood under the microscope. In order to avoid errors, much care has to be taken to make allowance for physiological alterations in the number of corpuscles which occur within the limits of health. Care must also be taken to withdraw and mount the specimen of blood sufficiently quickly, since the relative proportions of plasma and cells alter very rapidly by precipitation of the latter as soon as the blood is removed from the body.

For practical purposes it may be assumed that, under ordinary circumstances, the blood of a healthy adult should contain 5,000,000 red corpuscles and 8000 white corpuscles (leucocytes) per cubic millimetre. Age, individual peculiarities, the time of day at which the examination is made, and especially digestion, affect seriously the value of these figures. The examination should be made some four hours after a meal, and successive examinations should be made at the same hour each day.

Leucocytosis, or increase in the number of white corpuscles as a physiological process, is most marked in connection with digestion. In newly born infants and in women shortly after childbirth a high degree of physiological leucocytosis is found which may amount

to more than double the normal. As a pathological process, the interest of leucocytosis to the surgeon lies chiefly in connection with inflammatory processes. Leucocytes play an important part in the destruction of bacteria which have obtained entrance into the circulation. "Leucocytosis represents Nature's attempt to rid the blood and the system, by means of leucocytes and their products, of the bacterial and toxic causes of disease."*

Leucocytosis does not necessarily occur in all cases of abscess. If the pus be shut off from the general circulation by a well-marked abscess wall there may be no leucocytosis. The degree of leucocytosis is no guide to the amount of pus that is present. It indicates rather the amount of septic absorption that is taking place. But it must also be remembered that in some of the most severe and rapidly fatal cases of sepsis, as in very severe forms of fulminating appendicitis, there may be no leucocytosis.

In the diagnosis between internal hæmorrhage and deep-seated suppuration in the abdomen or pelvis (pyo-salpinx and hæmatocele, for example), a blood count may help. Diminution in red corpuscles and in hæmoglobin would suggest hæmorrhage; leucocytosis would be in favour of suppuration.

(ii) The various **kinds of leucocytes** that may be found in normal blood and under various pathological conditions are divided into groups according to their behaviour when stained with various aniline dyes. Some of the dyes, such as hæmatoxylon and methylene

* Ewing, "Clinical Pathology of the Blood," 1901, to which reference may be made for further details upon the whole of this subject.

blue, are basic; others, such as eosin and fuchsine, are acid; while a third class, composed of compounds of certain basic and acid dyes, of which Ehrlich's triacid stain is an example, are known as neutral dyes.

According to Ewing,* in stained specimens of normal blood the following four varieties of leucocytes may be found:

1. Lymphocytes, 22–25 per cent.
2. Large mononuclear leucocytes, 2–4 per cent. (basophile).
3. Polynuclear leucocytes, 70–72 per cent. (neutrophile).
4. Eosinophile leucocytes, 2–4 per cent. (eosinophile).

Besides these leucocytes, which alone occur in normal blood, there are found in pathological blood:

1. Myelocytes of various kinds, which are large mononuclear cells, some with neutrophile and others with eosinophile properties.
2. Mast cells, whose characteristic feature is the presence of large and small strongly basophile granules.

In the investigation of white corpuscles we must therefore take into account not merely the actual number of corpuscles present, but the relative number of the various kinds. For this purpose stained blood films are examined.

In distinguishing between lymphadenoma and leukæmia, for example, a blood examination is of great value. In the former disease it is the polynuclear cells that are in excess; in the latter it is the myelocytes (large mononuclear cells with granular eosinophile protoplasm) that afford evidence of the disease.

* *Loc. cit.*

In certain cases of disease due to parasitic intestinal worms (*e.g.*, trichinosis) there is an enormous increase in the eosinophile cells, which in normal blood are found to constitute only from 2 to 4 per cent. of the leucocytes.

(iii) Estimation of the **hæmoglobin** in blood is of much less importance than estimation of the number and nature of the corpuscles. Various forms of hæmoglobinometer may be employed. The essential principle is that of comparison of the colour of a solution of the blood of a known degree of dilution with a normal standard colour. Patients whose hæmoglobin has fallen very low (from hæmorrhage or other cause) may be unfit to bear severe operations necessitating further loss of blood. Mikulicz has laid down a rule never to operate on a patient whose hæmoglobin is under 30 per cent.*

(iv) The detection of **micro-organisms** in the blood is of less importance to the surgeon than their detection in the tissues and in the secretions.

Even in severe forms of pyæmia it may be impossible to find micro-organisms in the circulating blood. The discovery of the streptococcus or of the staphylococcus pyogenes aureus in the circulating blood of a pyæmic patient is a sign of very grave import.

The detection in the blood of the micro-organisms of such diseases as malaria, filariasis and sleeping sickness concerns the physician rather than the surgeon.

IV. **Use of anæsthetics and other drugs.**

General anæsthesia (by chloroform, ether, or nitrous oxide gas) is employed for purposes of diagnosis, principally with one or other of two objects.

* Cabot in Warren and Gould's "Text-book of Surgery," 1901.

(i) To produce muscular relaxation, in order that palpation may be more easily effected, as for example in the examination of an abdominal tumour or of an obscure fracture about the hip.

(ii) To avoid causing pain or distress to the patient in making painful or disagreeable examinations. In the case of young children the avoidance of fright is often desirable, especially if the examination is likely to be a prolonged one.

In making an examination under an anæsthetic, it should be remembered that it is quite possible to do the patient grievous bodily harm, if the examination be carelessly or injudiciously performed. A joint that is the seat of an acute or subacute inflammation may be made very much worse by a prolonged examination under an anæsthetic. An intra-abdominal abscess, more or less protected by the rigidity of the abdominal muscles while the patient is conscious, may easily be ruptured by careless manipulation during anæsthesia. A surgeon is sometimes a little apt to forget that he may by his examination be doing much harm to his patient, even although the latter is unconscious of any pain.

Local anæsthesia (by cocaine, or eucaine), for the purposes of diagnosis, is employed chiefly to allay pain or spasm during the instrumental examination of mucous cavities, such as the larynx or rectum.

The local anæsthesia produced by injecting these drugs into the spinal cord, although occasionally used for the purposes of treatment, is not used for merely diagnostic purposes.

Other drugs are sometimes used for diagnostic purposes.

Some, such as atropin, applied locally to the eye, render examination more easy. Atropin also, by causing irregularity of the dilated pupil, may render evident the existence of adhesions, and thus indicate previous iritis.

Others, by producing or not producing certain effects, may aid in diagnosis; thus an injection of pilocarpin by causing copious unilateral sweating of the head and face may be of use in demonstrating paralysis of the cervical sympathetic.

The injection of tuberculin may be useful in certain cases, the existence of an obscure tuberculous lesion being demonstrated by the reaction which takes place. Conversely, the absence of any reaction after the injection of the drug will show the absence of tuberculosis. Much care must be exercised, however, in the use of this drug. A pure and reliable sample must be employed, and it should be borne in mind that the employment of this method of diagnosis is not free from danger.

A purgative or enema by emptying the intestines may obviously be of great use in the examination of the abdomen or pelvis. A suspected tumour in these regions may, by such simple means, be proved to be nothing but a mass of impacted fæces.

The effect of the administration of such drugs as iodide of potassium, salicylate of soda, mercury, quinine, and very many others may afford important information with regard to diagnosis.

Conversely, drugs may hinder diagnosis, unless due allowance be made for their having been administered. The previous administration of opium to a case of acute abdominal disease may materially mask the symptoms. Morphia, chloral, and other drugs may

cause temporary glycosuria. Many other similar examples might be cited.

V. **Operative procedures.**

Operative proceedings are often necessary before a diagnosis can be made with certainty.

These procedures fall into the following groups:

(i) Puncture with grooved needle, trocar and canula, or aspirator. This is done to see whether fluid is present in the part and if so to withdraw it for further examination (cysts, abscesses, hydatids, &c.).

In making such a puncture, strict antiseptic precautions should be adopted, lest the introduction of septic matter should introduce a needless and perhaps serious complication. The surgeon must also consider carefully the anatomy of the parts which he is about to transfix, and avoid wounding a large vein, the intestine, the peritoneum, or other important structure. Indeed, the tapping of any localised fluid swelling through the non-adherent peritoneum is not free from grave risk and should rarely if ever be performed.

Further, the tapping of a fluid swelling may, by allowing the fluid to escape externally or into circumjacent tissues, lead to trouble. The tapping of a circumscribed septic abscess may lead to a dangerous septic cellulitis.

The puncture of a malignant tumour covered by healthy skin, peritoneum or other resisting structure may, by allowing the growth to extend along the line of puncture, cause serious fungation and dissemination. Malignant tumours of the thyroid gland, for example, if left to themselves rarely come through the skin. It is not uncommon, however, to see external fungation of the growth at the site of an injudicious tapping,

and the same may be said of many other parts of the body.

(ii) Removal (with scissors or knife) of a small solid portion of superficial ulcer, growth or other diseased part for microscopical or bacteriological examination.

The removal of a bit of a suspected epithelioma of the tongue for microscopical examination is a familiar example.

Such trivial operations are usually performed with the help of cocaine or some other local anæsthetic.

(iii) Incision of swellings or of cavities (*e.g.*, abdomen) for the purposes of examination by the eye, the finger or the hand, or by some instrument.

Direct incision may be the only means of distinguishing between a malignant tumour and a swelling of chronic inflammatory nature.

Abdominal section frequently affords the only means of clearing up a doubtful diagnosis of an obscure disease of the abdomen, such as early carcinoma of the stomach, disease of the pancreas, &c.

It may be laid down as a general rule that the larger operations of this class are not to be performed unless some important point as regards prognosis or treatment depends upon them. To cut into a malignant tumour and to do nothing more generally leaves the patient worse than he was before the operation. If, however, there is any reasonable prospect that the exploratory operation will pave the way for further curative or palliative treatment, it should be undertaken. Similarly, an exploratory abdominal section should not be performed merely for the purpose of diagnosis unless there is some reasonable prospect of doing good to the patient thereby.

In these days one hears a good deal about the complete safety of exploratory abdominal sections. Although an abdominal section performed upon a patient whose general health is good may be, and usually is, almost wholly devoid of danger, yet such is by no means the case if the patient is already very ill as the result of severe injury or advanced disease. In these cases a useless abdominal section may very easily shorten the patient's life.

Even the simplest abdominal section is not wholly free from the risk of causing peritoneal adhesions which may at some future period lead to fatal intestinal obstruction.

Before doing any large exploratory operation, it is well to ask oneself the question, "What good to the patient can be expected to follow this operation? Is there any reasonable probability or even possibility that, under favourable circumstances, the subsequent treatment of the case will be modified by what is found at this operation?"

Exploratory operation, merely to confirm or to make a diagnosis in a case in which no question of treatment arises is not justifiable, and is to be regarded merely as meddlesome curiosity on the part of the surgeon.

Occasionally a simple exploratory operation may be undertaken to settle the question of prognosis, even when treatment is wholly out of the question. But this should be done very rarely, and never except at the express wish of the patient and after all the facts of the case have been clearly laid before him.

PART II.

DISEASES

CHAPTER IV.

DISEASES OF THE NOSE, NASO-PHARYNX AND ACCESSORY SINUSES.

The examination of a case of disease of the nose comprises the examination of the external portion of that organ and of the interior. The latter is effected mainly with the help of reflected light, and with a probe or other instrument introduced into the cavity. Diseases of the posterior portion of the nasal cavity and of the nasopharynx are investigated by means of the finger introduced behind the soft palate, or by posterior rhinoscopy. In some few cases it is necessary to explore the nasal cavity by laying it open from the outside, or by splitting the soft palate, before a complete and satisfactory diagnosis can be made. It is well also in the investigation of a case of supposed disease of the nose to pay especial attention to the condition of neighbouring parts, such as the antrum, the frontal sinus, the ear, and the throat, since diseases of these parts are frequently associated with disease of the nose.

Diseases of the external portion of the nose require

but brief mention. Affections of the skin of this part do not differ essentially from those of other parts of the face. Certain superficial affections are particularly common in this part, notably tubercle (lupus) in young and rodent carcinoma in middle-aged and elderly subjects. The latter in its early stages is likely to be mistaken for a simple wart; the diagnosis is made chiefly by the tendency to slow and steady growth. In the later stages, when ulceration has occurred, the distinct slightly raised hard edge serves to distinguish it from all innocent forms of ulceration, while its slow growth and the absence of any considerable mass of new tissue at the base of the ulcer, together with the absence of glandular implication, are usually sufficient to distinguish it from epithelioma and other forms of malignant ulcer. The diagnosis of lupus of the nose is frequently facilitated by the presence of characteristic patches upon other parts of the face. The tendency to spread slowly, and gradually to destroy the soft parts of the nose, and the presence of non-ulcerated tubercles in immediate proximity to the ulcer, help in the diagnosis.

Destruction of the bones and cartilages of the nose is frequently caused by syphilis, the signs of which can almost always be seen also in neighbouring parts of the throat and mouth.

Destruction of the septum of the nose causes a flattening of the bridge, which is very suggestive of syphilis. The most marked flattening is seen in those cases in which the acute disease has occurred in childhood while the bones were still soft.

An extreme case of atrophic rhinitis may also present marked flattening of the bridge of the nose.

Marked widening of the external nose generally

indicates the existence of a tumour, growing slowly within the nasal cavity and expanding it. Multiple simple polypi of long duration occasionally produce this deformity. The firmer fibrous growths that spring from the roof of the pharynx and nasopharynx are still more likely to cause it. Malignant tumours generally cause this widening only in their later stages, when diagnosis no longer presents any difficulty. It is obvious that tumours of any kind situated at the anterior part of the nose are more likely to cause deformity of the exterior than are those that have their origin far back in the neighbourhood of the pharynx.

Disease of the interior of the nose generally causes one or other, or all of the following three symptoms: I. Obstruction; II. Discharge; III. Perverted sense of smell. As it is usually for one or other of these that the patient seeks advice, it will be convenient to treat of each separately.

I. **Obstruction** to the passage of air through the nostril is easily produced by anything that causes swelling of the lining membrane of the narrower parts of the nasal cavity; by displacements of any part of the wall of the cavity, especially the septum; by granulation tissue, and by new growths springing from the wall of the cavity, or projecting into it from neighbouring parts; by foreign bodies introduced into the nose; or, by accumulations of inspissated mucus (crusts).

The obstruction may be either in the nose itself, or further back in the nasopharynx; thus, cicatricial adhesions between the soft palate and the back of the pharynx, or a tumour of the nasopharynx may cause complete obstruction to the passage of air through the nares.

Bilateral obstruction, affecting both nostrils, is due

either to some nasopharyngeal cause, such as adenoids, or to some general cause affecting the whole nasal region, such as general catarrh or inflammation of the nose, or to the existence of disease affecting both nostrils simultaneously, such as multiple polypi.

Growths in the nasopharynx, such as fibromata and sarcomata, and even simple mucous polypi, if unusually large, may cause marked depression and bulging of the soft palate, easily visible and palpable from the mouth. A finger passed up behind the soft palate will confirm the diagnosis of a tumour in that situation.

Unilateral obstruction, affecting one nostril only, may be due to

(i) **Displacement of the septum nasi** either from congenital malformation, or more commonly from old injury, such as a blow or fall upon the nose. Inspection of the nostrils shows a red, bulging swelling on the affected side, and corresponding hollow on the opposite side. It is the presence of this hollow on the unaffected side which serves to distinguish mere deviation of the septum from tumours and inflammatory and other swellings of the septum, for which at first sight it may be mistaken.

(ii) **Disease of the septum,** usually acute or chronic inflammation (simple abscess or inflammation due to syphilitic, tuberculous, or other disease of the cartilage or bone of the septum), occasionally a tumour originating in the septum.

In most of these cases the swelling is to be seen on both sides of the septum. The absence of the corresponding hollow on the opposite side serves to distinguish these from mere deviation of the septum.

Examination with a probe shows that the swelling

springs from and is attached to the septum ; this serves to distinguish septal swellings from the common polypi which practically never arise in this structure.

(iii) **A foreign body** introduced from without. Here the history may help us, unless the patient is a very young child or an older patient who either has no knowledge of the introduction of the foreign body, or intentionally wishes to deceive the surgeon. Examination with reflected light and a probe will generally suffice to reveal the nature of the foreign body ; if it be much coated with mucus, it may be necessary to wipe or wash the latter away before the examination can be properly made. Foreign bodies are often of a black colour from the dried blood which coats them. A piece of necrosed bone may very closely resemble a foreign body introduced from without.

(iv) **Disease of the soft parts covering a turbinated bone**, usually the inferior. The commonest disease is a chronic form of hypertrophy (hypertrophic rhinitis). In this disease the soft parts covering the bone are much swollen, and form mulberry-like masses, most marked at the anterior or posterior ends of the bone. These masses can be seen by anterior or posterior rhinoscopy. Sometimes the mucous membrane along the whole of the lower edge of the bone forms a thick, pendulous, fringe-like mass.

(v) **Polypi,** an extremely common cause of obstruction.

The common mucous polypus usually presents itself in the form of a pale reddish or greyish mass. Its colour alone is usually sufficient to distinguish it from a swelling of the septum or of a turbinate bone, which is of a brighter red. Examination with a probe will usually show that it is movable. Polypi most commonly spring

from the middle turbinated bone and from the upper part of the nostril rather than from the lower. They are generally multiple, and often occur in both nostrils at once. The presence of a nasal polypus together with a purulent discharge generally indicates disease of an accessory sinus.

The far more serious disease, the fibrous polypus, or angeio-fibroma, as it is sometimes called, from the number of vessels within it, presents itself as a rounded mass blocking up the whole nostril and is of a much deeper red colour than the simple mucous polypus. The fibrous polypus usually grows from the roof of the nostril (base of the skull), and is especially apt to project into the nasopharynx. In this situation it can usually be both seen and felt. A tumour of this kind is usually seen in young adults, and if allowed to attain a considerable size may cause great expansion of the nose, and absorption of the neighbouring maxillary bone. The displacement of the facial bones may lead to much external deformity. It is sometimes difficult to distinguish a fibroma from a sarcoma or other malignant tumour. Nasal fibromata, like most fibromata that are covered with mucous membrane, have a great tendency to bleed. Repeated severe attacks of hæmorrhage in a young man with unilateral nasal obstruction should always rouse a suspicion of fibroma and demand a careful and thorough examination of the nose.

(vi) **Malignant tumours** that block up the nostril and are visible on inspection of the nasal cavity usually present as rough, friable, ulcerated masses, that bleed readily when touched with a probe. The diagnosis has to be made by the short history and by the evidence of local infiltration.

Malignant tumours of the nose may spring not only from the lining membrane of the nose itself, but from the various bones and mucous cavities that surround that cavity. Hence in the examination of a suspected malignant tumour of the nose care should be taken to examine the **palate**, both hard and soft, which may show distinct evidence of local infiltration; the **naso-pharynx**, which may reveal the presence of a characteristic mass of growth; the **antrum**, in which such a tumour often originates; and the inner part of the **orbit**. Tumours originating in the upper part of the nasal cavity, where they are not easily accessible to direct examination, will often betray their presence to a finger pressed deeply into the inner corner of the orbit. The thin papery bone in this region is more easily perforated by a malignant tumour than the hard and thick nasal bones and nasal processes of the superior maxillary bones which cover its anterior surface. Lastly, it should be remembered that tumours originating in the upper regions of the nose, in the ethmoid and sphenoid bones, for example, often extend upwards into the cranial cavity itself. Cerebral symptoms, therefore, such as persistent headache, may aid in the diagnosis.

II. **Discharge** of—(*a*) Mucus; (*b*) Pus; (*c*) Blood.

(*a*) **Mucus.**—An increase in the amount of mucus discharged from the nose occurs in any condition of catarrhal inflammation of the nose or neighbouring sinuses. It may also occur in cases of polypi, in which the tumours become congested or inflamed. It is not, as a rule, a sign of much importance; it generally indicates trivial rather than serious disease of the nose.

Many cases of suppuration connected with disease of the nose or accessory sinuses begin, however, with a

catarrhal mucous discharge which subsequently becomes muco-purulent and then purulent. A chronic mucoid or muco-purulent discharge from both nostrils in children is generally due to adenoid vegetations. The diagnosis is made by the presence of the other signs and symptoms of that disease. The characteristic facies, the habitually half-opened mouth, the nocturnal snoring, sometimes associated with poor development of both mind and body, together with the physical examination of the nasopharynx by finger or reflected light, seldom leave any doubt as to the true nature of the nasal discharge.

(*b*) **Pus.**—Purulent and muco-purulent discharges are of far more importance than those which are merely mucous. They often indicate exceedingly troublesome and intractable, if not actually dangerous, diseases. An acute muco-purulent or purulent discharge from both nostrils indicates infection by some micro-organism such as that of diphtheria, gonorrhœa, or glanders. The commoner exanthemata, such as measles and scarlet fever, often present this complication. So does syphilis in its secondary stage, of which the congenital form, as in the "snuffles" of infants, affords a familiar example. If the general symptoms of these various diseases are not sufficiently marked for the establishment of a diagnosis, the history may afford valuable help, or bacteriological examination may reveal the presence of some characteristic bacillus. In newly born infants an acute nasal discharge generally means gonorrhœa, and infection has probably been conveyed from the vaginal discharges of the mother, either directly at birth, or indirectly by means of an infected towel or cloth. The discharge due to congenital syphilis first appears a few weeks after birth.

In a case of acute purulent nasal discharge it is not generally possible to make a very thorough or satisfactory examination. If the discharge is gently wiped or washed away it may be possible to obtain a view of some portion of the interior of the nose, but generally such examination had better be postponed until the acuteness of the discharge has subsided.

It must never be forgotten that careless or injudicious syringing in a case of infective nasal discharge may drive the infective material up the Eustachian tube and set up an acute inflammation of the middle ear.

With reference to foul smell in connection with nasal diseases, it may here be stated that this is due to the decomposition of pus and mucus in the nose. It is especially apt to occur in cases in which either of these products is retained for a long time in the nose. It is particularly common in cases in which necrosed bone is present; in a child it sometimes indicates the presence of a foreign body.

The disease known as atrophic rhinitis is characterised by the formation of a small quantity of nasal discharge which quickly dries and produces crusts. These remaining in the nose, decompose readily and cause a horrible smell (ozœna), which is the most noticeable feature of the complaint.

A very fœtid discharge is also met with in cases of tertiary syphilitic disease. This disease usually affects the septum of the nose rather than other parts, and is characterised generally by the occurrence of deep ulcers and considerable tendency to necrosis. Deep ulceration extending through the palate into the mouth is not uncommon, and is highly characteristic.

A chronic nasal suppuration usually has its origin in

some local disease of the nose or neighbouring parts. It must always be borne in mind that a purulent nasal discharge may be derived not from disease of the nose itself, but from disease of any of the neighbouring parts, especially the various accessory cavities (antrum, frontal, ethmoidal and sphenoidal sinuses).

Moreover, a nasal discharge does not necessarily present itself at the anterior nares, but may run backwards into the pharynx, and perhaps thus escape observation.

If a chronic suppuration exist, for which no cause can be found in the nostril, and especially if it be unilateral, then it should be suspected that the source is in one of the accessory cavities. The cavity which is most often the seat of chronic suppuration is undoubtedly the antrum ; less commonly affected are the frontal, ethmoidal and sphenoidal sinuses.

The source of the discharge can sometimes be ascertained by direct examination. After cleaning the nostril with a cotton wool mop, it may be noticeable that the pus reappears in a particular place. Thus if it comes from the middle meatus it may be suspected to be derived from the antrum or perhaps the frontal or anterior ethmoidal sinuses, since these cavities all open into the middle meatus. Similarly pus in the superior meatus is probably derived from the posterior ethmoidal or sphenoidal sinuses.

Local tenderness is sometimes a guide to the sinus affected. A dull pain in the cheek may indicate antral suppuration, pain in the forehead (brow ague) may point to the frontal sinus.

The pain connected with sphenoidal suppuration is less definitely located, but the patient complains of headache.

The amount of pain produced by suppuration within

the accessory sinuses depends largely upon whether the pus is shut up within the cavity or free to flow out. If free to flow out, the diagnosis can be made largely by direct observation of the source of the discharge. If not free, then the symptoms of painful distension of the sinus are more marked. In some severe cases there may even be œdema of the soft parts over the sinus, and in still more extreme cases septic osteomyelitis may complicate suppuration in these sinuses:

The diagnosis of pus retained within the antrum is sometimes facilitated by making the patient lean his head towards the sound side. A sudden flow of pus shows emptying of the antrum through the now dependent opening.

Transillumination is in many cases a valuable means of detecting suppuration in the antral or frontal sinuses.

The examination must, of course, be made in the dark. A small electric light is introduced into the patient's mouth and the lips are closed. Normally, much light is then seen to come through the cheeks, a triangular area in the infraorbital region being especially well illuminated. If the antrum be diseased, the rays of light will not pass so readily through it, and the infraorbital region does not undergo this illumination, but remains dark. Failure to get transillumination does not, however, necessarily indicate empyema of the antrum. Solid growths in the antrum, thickened mucous membrane, and other abnormal conditions, may produce the same effect. Even within the limits of health there is, however, some variation in the degree to which the antrum can be transilluminated. Nevertheless, taken together with the presence of a chronic discharge from the middle meatus, it is often a valuable

means of diagnosis. Transillumination may also be applied to the detection of disease of the frontal sinus. In this case a small electric lamp is pressed against the soft tissues at the inner and upper angle of the orbit. The healthy frontal sinus should then present as a bright patch of light, while the diseased one is not illuminated. It should be remembered that thin pus may not affect translucency. Conversely interference with the passage of light often means diseased mucous membrane, rather than the actual presence of pus.

In many cases the diagnosis of pus within the antrum can be made only by puncture. This is best done through the inner wall of the antrum towards the anterior part of the inferior meatus of the nose. The puncture should be made in a backward and outward direction by means of a small straight trocar and canula.

(*c*) **Blood**.—Hæmorrhage from the nose indicates a breach of surface in some part of the mucous lining of that cavity. It may be due to traumatism, in which case it is of but little importance unless of so severe a nature and accompanied by such other grave symptoms as to suggest a fracture of the base of the skull.

Spontaneous hæmorrhage is not uncommon in children, and an occasional attack does not necessarily mean anything serious.

In middle-aged or elderly people spontaneous nasal hæmorrhage is of more serious import. It often betokens serious disease of such viscera as the heart, kidneys, or liver, and should demand a careful examination of these parts. There are many general diseases, too, such as leucocythæmia, hæmophilia, and others, in which a tendency to hæmorrhage is a prominent feature,

and a nasal bleeding may be the first indication of one of these.

At any age a spontaneous and severe hæmorrhage may indicate the existence of a tumour; in a young subject fibroma or sarcoma is the most likely form; in an older person some form of carcinoma.

As repeated attacks of spontaneous hæmorrhage are often for a considerable time the only obvious signs of a tumour, they should always demand a careful and thorough local examination.

In various inflammatory and ulcerative conditions of the nose hæmorrhage may occur. In these cases, however, it is the accompanying muco-purulent or purulent discharge that is the more prominent and obvious feature, and diagnosis of the cause of the hæmorrhage does not usually present any difficulty.

III. **A perverted sense of smell** may be due to disease either of the nose itself or of the central nervous system. Local disease or foul discharges may cause a bad smell to be noticed by the patients. Frequently, however, a foul smell which is very noticeable and disagreeable to others, is unnoticed by the patient himself, owing to the disease having affected the olfactory nerve endings. This is especially the case with atrophic rhinitis.

If a patient complains of any alteration in the sense of smell, a very careful local examination of the interior of the nose should first be made. If no evidence of disease can be discovered, then, and then only, is it permissible to consider that the central nervous system itself may be at fault. The diagnosis has then to be made by the existence of other signs and symptoms of cerebral disease.

CHAPTER V.

DISEASES OF THE EAR.

PATIENTS who are the subjects of disease of the ear usually seek advice on account of one or other of the following conditions :

1. Some affection of the external ear (auricle) such as deformity, swelling, inflammation, ulcer, &c.
2. Discharge from the meatus.
3. Deafness.
4. Noise in the ear (tinnitus).
5. Pain.

Each of these may be considered separately.

1. Affections of the auricle differ in no essential particular from those of the skin and cellular tissue in other parts of the body, and need, therefore, no detailed description.

2. Discharge from the meatus is usually purulent, and often, from decomposition, has a foul odour. It may be derived from any inflammatory condition of the delicate skin lining the meatus, such as eczema. It may have a more deep-seated, and, consequently, more serious origin in disease of the bony wall of the meatus (necrosis, caries). Most often, however, when profuse and of long standing, it comes from the middle ear, escaping through a perforation in the membrane, and is

indicative of inflammatory trouble of the wall of that cavity, or of its associated chamber, the mastoid antrum.

The source of the discharge must be ascertained by direct examination with the speculum.

3. Deafness may be due to—

(*a*) A mere obstruction in the meatus, such as a swelling, inflammatory or otherwise, springing from the wall of the meatus; or a foreign body, such as a bead or a pea, or other substance introduced from without; or an accumulation of wax.

(*b*) Something which interferes with the normal vibration of the membrana tympani, or with the mechanism in the middle ear (ossicles, &c.) which serves to conduct the vibrations of sound to the internal ear. Obstruction of the Eustachian tube, by preventing free access of air to the middle ear, and disease of the membrane itself (chronic inflammatory thickening, perforation, &c.) are thus common causes of deafness.

(*c*) Affections of the internal ear itself or of its associated auditory nerve, or even of the brain itself (nerve deafness). The use of the tuning fork (see page 61) is a valuable aid in the differential diagnosis between deafness due to disease of the nervous portion of the ear and that due to some fault in the external or conducting portion of the organ.

4. Noises in the ear (tinnitus) are due to irritation of almost any part of the organ of hearing; thus, a mass of wax in contact with the membrane, an inflammation of the middle ear, or an affection of the auditory nerve

or brain, may give rise to this symptom. Its presence should demand a very careful examination of the ear, that the cause of the irritation may, if possible, be ascertained and removed. It is frequently a most troublesome and intractable symptom.

5. Pain is most severe when it is due to inflammation causing tension. Thus a minute abscess or boil between the bony wall of the meatus and its lining may cause excruciating pain; inflammation of the middle ear or of the antrum, or of any part of the surrounding bone, may likewise be productive of much pain, which is severe in proportion to the intensity of the inflammation and the tension of the inflammatory products.

Ulceration of the middle ear does not usually in itself cause pain, provided that there is a free vent for the discharge through a perforated membrane. But when such discharge is pent up, or when the dense surrounding bone is involved in the inflammatory process, pain becomes a prominent feature.

Tenderness over the mastoid process is a common accompaniment of deep-seated inflammation of the middle ear, involving the mastoid antrum.

It must not be forgotten that a pain felt in the ear may be a referred pain due to disease in some other part; of this, the common pain in the ear due to a carious wisdom tooth affords a good example.

Physical Examination of the Ear.

The examination of affections of the auricle, which is accessible to direct inspection and palpation, requires no special description.

The mastoid region should be examined to see if it

presents any evidence of inflammation, such as redness, œdema, or tenderness.

The meatus must be examined by direct inspection, usually by means of a speculum and reflected light.

If, as is often the case, the meatus is obstructed by wax or by discharge from the ear, these may have to be removed by gentle syringing or sponging with cotton wool before the meatus can be thoroughly inspected.

In the introduction of a speculum, due regard should be had to the curved shape of the meatus, and this tube should be straightened as regards its cartilaginous part by gentle traction on the auricle. This traction should be made upwards and backwards in the case of an adult, directly backwards in that of a child.

In syringing the meatus the nozzle of the syringe should be directed upwards, so that the stream of warm fluid impinges against the roof of the meatus and not directly against the membrana tympani. Masses of wax and other foreign bodies are generally easily recognised by their colour, and if necessary by touching with a probe. Narrowing of the meatus by inflammatory swelling of the soft parts of its wall is generally easily recognised by the smallness of the aperture, and by the tenderness and other signs of inflammation.

Narrowing of the meatus by bone is generally due to some chronic inflammatory affection of the surrounding bone, very rarely to genuine exostosis.

Swelling of the wall of the meatus may entirely obscure the membrane and prevent any inspection of it.

Much with regard to disease of the ear, and especially of the middle ear, may be learnt by simple **inspection of the membrana tympani.**

It should be remembered that the membrane is situated,

not transversely, but obliquely across the bottom of the meatus, the upper and posterior borders being nearer to the observer than are the lower and anterior.

The normal membrane has a bluish grey colour with a silvery lustre ; the latter is most marked at the lower and anterior part, where there is in health a bright, shiny, triangular area.

Running downwards and backwards to near the centre of the membrane is the long process (handle) of the malleus, while at the upper end of this is a slight projection, the short process. Passing backwards and forwards from this short process are two faintly marked ridges, the longitudinal folds.

We have to notice the colour of the membrane and its lustre, the presence of perforations in it, and of polypi or granulations springing from it.

Further, the degree of concavity or convexity of the membrane affects the obliquity of the handle of the malleus and the prominence of the short process and longitudinal folds, and thus afford valuable evidence of obstruction to the Eustachian tube.

Recent acute inflammation of the membrane causes naturally increased vascularity and loss of lustre. The handle of the malleus is at the same time more or less obscured from view. Chronic inflammation of the membrane leads to thickening of it and loss of both lustre and transparency, so that the handle of the malleus is much less visible.

The apparent colour of the membrane when transparent is naturally affected by the colour of whatever lies behind it. Thus, if the middle ear be full of pus a yellow colour is imparted to the membrane.

A collection of fluid, partially filling the middle ear,

may be easily visible through the membrane and is recognised by its horizontal upper border marking the upper limit of the fluid. This line naturally remains horizontal when the ear is inclined forwards or backwards, and the alteration thus produced in its relations to the various parts of the membrane affords a ready means of detecting its nature.

An unusually thin membrane may derive a reddish colour from the inner wall of the tympanum, visible through the membrane. The thin portion of membrane that covers a healed perforation may thus have a reddish colour, and may resemble in this respect a perforation itself, which allows the mucous membrane of the inner wall to be directly visible.

A thin portion of membrane will alter in colour if air be injected through the Eustachian tube; the thin portion then becomes distended and convex outwardly.

A polypus or polypoid granulation springing from the membrana tympani, or coming through it, may from its red colour resemble to a certain extent a perforation, but can usually be distinguished without difficulty by touching it with a probe.

In cases of extensive destruction of the membrane, the inner wall of the tympanum may be freely exposed, the membrane being represented merely by a narrow ring at its periphery. In some of these cases the ossicles are more or less exposed to view, in others they have entirely disappeared.

Inflation of the middle ear as a means of diagnosis.—Much valuable information may be obtained by observing the appearance of the membrane before and after inflation of the middle ear, especially

in cases in which there is some obstruction to the Eustachian tube.

An obstruction in the Eustachian tube leads to the absorption of the air in the middle ear and consequent indrawing of the membrane. A thin portion of the membrane may be more yielding, and consequently more indrawn than the rest. After inflation, the indrawn membrane or any portion of it tends to become less concave or even convex. Inflation of the middle ear may in some cases be performed by simply directing the patient to close the mouth and nostrils firmly and then to blow hard. Air is thus forced along the Eustachian tube into the middle ear and the patient is conscious of a click in the ear.

More often inflation is performed by Politzerisation. The patient is directed to take a mouthful of water and hold it in his mouth with the lips closed. One nostril is closed and into the other is inserted the nozzle of an india-rubber tube having a bag at the other end.

At a given signal the patient swallows, while the surgeon at the same time squeezes the bag sharply and air passes along the Eustachian tube which has been opened by the act of swallowing.

In other cases where these methods have not succeeded, it may be necessary to inject the air directly into the tube by means of a Eustachian catheter. An auscultation tube passing from the ear of the patient to that of the surgeon is used at the same time. To pass a Eustachian catheter, the well-lubricated instrument should be passed with the point downwards along the floor of the nostril till it can be felt to impinge against the posterior wall of the pharynx.

The point should then be rotated inwards and the catheter withdrawn a little until the curved end can be felt to hook against the posterior edge of the septum of the nose. The operator should then rotate outwards the end of the catheter, through a little more than half a circle, and again push it gently forwards. The point of the catheter will then usually be found to have entered the orifice of the Eustachian tube. Air or other fluid can then be injected through a tube or syringe attached to the catheter. In passing a Eustachian catheter the utmost gentleness should be employed.

It should be added that in some cases deflection of the nasal septum interferes with the passage of a catheter. In a troublesome case the introduction of the Eustachian catheter may be aided by vision by means of a speculum and reflected light.

The following conclusions may be drawn from the effects of Politzerisation. If no sound be heard in the affected ear by the patient at the moment of inflation, if no alteration be produced in the appearance of the membrane, and if no improvement in the hearing follow, then it is probable that the Eustachian tube is completely obstructed.

Bubbles of air visible in the middle ear after inflation indicate the presence of fluid in that cavity. A whistling noise heard at the moment of inflation indicates a perforation of the membrane. In order to hear this whistling best, the ears of the surgeon and patient should be connected by an india-rubber tube.

Lessening of the concavity of the membrane as shown by diminution in the prominence of the short process of the malleus and of the posterior fold, and altera-

tion in the inclination of the handle of the malleus, indicate an indrawn membrane. This in its turn indicates some obstruction to the Eustachian tube.

The conversion of local dark areas on the membrane into light areas indicates that locally depressed areas have become converted into **convex prominences** and show the existence of areas of thin membrane, healed perforation, &c.

Use of the tuning-fork.—Apart from its use as a mere test of the amount of hearing present, the great use of the tuning-fork is in the diagnosis between deafness due to the internal ear and central nervous system, and that which is due to obstruction in, or disease of, the conducting apparatus.

Normally, in a healthy person the vibrations of a tuning-fork can be heard not only when placed opposite the ear, but also when placed on the top of the head, on the chin, or between the teeth. When in the latter situations, some of the vibrations are conducted directly along the bones of the head to the internal ear and there produce the sensation of hearing. Normally a tuning-fork can be heard opposite the ear after it has ceased to be heard on the vertex. That is, the vibrations are still carried to the ear by means of the conducting apparatus, meatus, membrane and ossicles. If there be an obstruction to the conducting apparatus, *e.g.*, a lump of wax in the meatus, then the tuning-fork on the vertex is heard better in the affected ear than in the sound one; the tuning-fork held opposite the ear is naturally not heard so well on the affected as on the sound side (Weber's test).

The reason for all this is obvious. The tuning-fork on the vertex transmits vibrations along the bone to the ear;

some of these pass to the internal ear, others pass outwards and, if there is no obstruction, are lost. If, however, there is an obstruction, these latter vibrations are reflected inwards and pass to the internal ear, reinforcing those which have gone directly to it through the bone.

In cases of deafness due to disease of the internal ear, auditory nerve, or brain, the vibrations of a tuning-fork on the vertex are either not heard at all, or they are heard less plainly on the affected than on the unaffected side of the head. It must be remembered, however, that the hearing of a tuning-fork placed upon the vertex varies considerably in different individuals even within the limits of health. Weber's test is naturally most useful in cases of unilateral deafness.

Another test is that of Rinne, in which the tuning-fork is placed upon the mastoid process and the hearing by absolute bone conduction compared with that obtained when the tuning-fork is held opposite the meatus.

If the surgeon's own hearing is normal he may estimate the degree to which the patient's hearing by bone conduction is impaired by placing the fork upon the patient's mastoid until the vibrations can no longer be heard. He then immediately transfers it to his own mastoid and notices the further time during which the vibrations are still audible to himself.

Intracranial Complications of Middle-ear Disease.

Complications by no means uncommon in the later stages of suppurative disease of the middle ear are those which are due to the extension of inflam-

mation through the temporal bone to the interior of the cranial cavity. On account of their seriousness and the great danger to life which they involve, they are of the utmost importance. Not only the aural specialist but the general surgeon and physician should be thoroughly familiar with their symptoms in order that effective treatment may be adopted at the earliest possible period.

Complications of ear disease which are, and remain, limited to the ear itself and neighbouring petrous bone, although serious enough as regards hearing, and sometimes as regards the production of facial paralysis, are but rarely *in themselves* dangerous to life.

It is quite otherwise, however, with intracranial complications, which only too often lead to the death of the patient. The subject is, moreover, an important one, owing to the insidious nature of the symptoms, the difficulties of diagnosis and the ease with which they may be overlooked. With the possible exception of certain rare cases of pyæmic secondary abscesses of the brain, which may have no direct communication with the ear, intracranial complications of middle-ear disease are always due to direct extension of inflammation from the ear to the interior of the cranial cavity. The suppurative process may have led to gradual erosion of the surrounding bone until the cranial cavity has been actually perforated. The thin roof of the tympanic cavity is frequently perforated in this manner. Or the inflammation may spread along one of the numerous small bony channels which run in various parts of the petrous bone. Thus the canal of the auditory nerve, or the canals transmitting smaller

nerves or veins, may be the paths along which the suppuration extends.

Intracranial complications of middle-ear disease may for clinical purposes be divided into three groups.

1. **Abscess of the brain** (temporo-sphenoidal or cerebellar).

2. **Infective thrombosis of the lateral sinus.**

3. **Meningitis** (general or local, including **subdural abscess**).

A well-marked uncomplicated case of each of these affections, but especially of the first two, has usually distinctive and easily recognisable symptoms. The diagnosis in such cases is not difficult. Frequently, however, two or even all three of these conditions coexist, and the characteristic symptoms of one are masked by those of another. It often becomes a very difficult problem to unravel the symptoms and to say how far they point to one or other of these conditions.

Thus a localised meningitis is frequently present both with abscess of the brain and with lateral sinus thrombosis; a diffuse meningitis not uncommonly complicates the later stages of cerebral abscess.

With very rare exceptions, the intracranial complications of middle-ear disease do not supervene except in connection with chronic and long-continued disease of the ear. A history of otitis media extending over at least several months, or other evidence of chronic disease, are important factors in the diagnosis.

That the suppurative process has spread from the temporal bone to the interior of the cranium may often be suspected by the abrupt cessation of a chronic discharge from the ear, especially if this cessation of discharge be accompanied by increased pain, by head-

ache, by a rigor, by vomiting, or by drowsiness. In the earlier stages of intracranial suppuration, whatever form it may assume, there is often some elevation of temperature.

Abscess of the Brain.

The characteristic symptoms upon which we may rely in the diagnosis of abscess of the brain are: (1) Mental dulness and apathy passing on to drowsiness and then to unconsciousness. (2) A temperature which, although at first perhaps somewhat raised, soon begins to fall below normal. (3) A slow pulse.

A steadily falling subnormal temperature and pulse, together with increasing drowsiness, occurring in a patient who is the subject of chronic otitis media are in themselves sufficient for the establishment of the diagnosis of an intracranial abscess.

Vomiting and optic neuritis, symptoms of any cerebral tumour, are likewise common symptoms of cerebral abscess but are not necessary for the diagnosis.

Paralytic symptoms, such as weakness of the muscles of one side of the face,* of one arm or leg, are late symptoms met with in cases of large abscess. In the diagnosis of abscess of the brain at the stage at which alone treatment is likely to be effective, they are therefore seldom met with. Convulsions, rigidity, muscular twitchings, sighing respiration, and other grave symptoms may also occur at very late stages of the disease, and indicate extension of the abscess into

* Provided that it is not due to involvement of the trunk of the facial nerve in the disease of the middle ear itself.

the ventricle or on to the surface of the brain ; they are on this account of little value. Abscess of the brain in connection with otitis media occurs almost invariably either in the temporo-sphenoidal lobe or in the cerebellum. If the roof of the tympanic cavity be the point at which the pus has penetrated the cranium, then the superjacent temporo-sphenoidal lobe is the part in which the resulting abscess will be found. If the posterior wall of the petrous bone be the seat of the perforation, then the cerebellum, which lies in contact with it, will become the seat of the abscess. Perforation of the posterior wall leads, however, more often to suppurative thrombosis of the lateral sinus than to cerebellar abscess.

Localisation of Abscess of the Brain.

Even when the diagnosis of abscess of the brain has been made, it may be an extremely difficult matter to decide where the abscess is situated. In the vast majority of cases, as already mentioned, the abscess may be assumed to be in the temporo-sphenoidal lobe or in the cerebellum. Whether the right or left side be affected is a matter generally determined by the pain, discharge, and other local manifestations of disease of the ear. But sometimes, when both ears are affected to an equal extent, or when the patient is unconscious and no history is obtainable, there may be great difficulty in determining the side on which the abscess is situated. The presence of optic neuritis more marked in one eye, or the involvement of a cranial nerve, may be of assistance.

If any paralysis of the face, arm, or leg be present,

it will be found on the side opposite to the abscess if the latter is in the temporo-sphenoidal lobe, on the same side if it be in the cerebellum.

The diagnosis between cerebellar and temporo-sphenoidal abscess is often most difficult. Severe occipital headache points to the cerebellum. Vomiting, too, is more often marked in the cerebellar abscess. There may also be obvious inco-ordination of movement. The staggering gait of cerebellar disease is well known, but is by no means invariably present.

A valuable sign of cerebellar disease, and one which indicates the side on which the lesion is situated, is the following. The patient is asked to stretch his arms out in front of him and to perform rapid rotatory movements of both hands simultaneously. The hand of the side on which the cerebellar disease is situated will not be able to execute this movement so readily as the opposite one. If the patient is then directed to quickly raise both arms above his head, and to continue the rotatory movements, the hand of the affected side is waved about in an irregular manner, while the opposite hand continues to rotate as before.

Careful examination of the middle ear itself will often afford valuable evidence as to the situation of the abscess by indicating the part in which the perforation of its wall has taken place. Thus it may be possible to pass a bent probe up through a perforation in the roof of the tympanum. This would indicate strongly that the abscess was in the temporo-sphenoidal lobe rather than the cerebellum. Owing to the greater thickness of the posterior wall of the tympanum it is seldom possible to pass a probe through the perforation that leads to the cerebellar abscess.

Infective Thrombosis of the Lateral Sinus.

The symptoms of this affection are usually exceedingly characteristic. They are those of acute septic poisoning and are similar to those of suppurative thrombosis of any other large vein.

Rapid and great elevation of temperature, with frequent and marked remissions, in which the temperature falls below normal; rapidity of pulse, frequent and severe rigors, sweats, restlessness and excitability, often delirium, together with the early onset of pulmonary symptoms denoting general septic infection, are the symptoms characteristic of this severe and very fatal complication of middle-ear disease.

Tenderness and perhaps swelling along the course of the internal jugular vein often aid in the diagnosis, but it must be remembered that in many cases of chronic disease the lymphatic glands between the angle of the jaw and the mastoid process are inflamed. The swelling and tenderness thus caused may readily be mistaken for those of thrombosis of the upper part of the jugular vein.

Meningitis.

The symptoms of meningitis vary greatly according to the severity of the disease and its situation. Its onset is usually insidious and may easily be overlooked. Persistent headache and delirium are two of its most constant symptoms. Vomiting, optic neuritis, irregularity of pulse, slight or considerable elevation of temperature, affections of various cranial nerves, may

all of them be present; but, on the other hand, any one or all of them may be absent.

When the meningitis affects the base of the brain, the cranial nerves are most likely to be affected. Meningitis affecting the posterior fossa is especially apt to give rise to rigidity of the muscles of the neck and retraction of the head, which thus become important elements in the diagnosis.

A localised meningitis of the dura mater is often accompanied by collection of pus between the dura mater and the bone. In such a case, gradually increasing drowsiness becomes a prominent feature.

CHAPTER VI.

INABILITY TO OPEN THE MOUTH.

In investigating a case in which the above is the most prominent feature, attention should be directed first of all to the soft structures (muscles and others) which connect the two jaws, since it is in these parts that the cause of the trouble is most likely to exist.

By far the most common cause of inability to open the mouth is inflammation of the soft parts around the muscles of the lower jaw (generally connected with bad teeth), or the results of such inflammation.

Spasmodic contraction of the muscles often accompanies the inflammation. In the acute stage of the inflammation, while pain and swelling are present, and probably a recent history of dental trouble is fresh in the patient's mind, there is but little difficulty in diagnosis. Much more obscure are those cases in which all evidence of acute inflammation has subsided. There is no evidence of dental trouble, no swelling can be detected anywhere, and yet the jaws are firmly clenched together and cannot be separated. In such cases careful attention to the history will frequently point to dental trouble of one kind or another, and it may become obvious that the present closure of the jaws is due to fixation of muscles owing to the organisation of inflammatory products in and around them.

Inflammation due to causes other than those connected with the teeth may lead to a similar closure of the jaws. Thus a gumma, or other inflammatory swelling in any one of the muscles of mastication, may cause closure of the jaws. Rarely a tumour situated in one of the muscles may produce the same effect.

A thorough examination, then, of the temporal fossæ and of the regions of the masseter and pterygoid muscles should be made in every case of closure of the jaws.

Ulceration inside the cheek or pharynx and the scarring consequent upon the ulceration, are also common causes of closure of the jaw. Inflammatory induration round an ulcer, or the fibrous tissue of a healed ulcer, can generally be detected without difficulty by passing a finger inside the cheek. Old cicatricial bands, the result of cured cancrum oris, afford good examples of this mode of closure of the jaws in children. In elderly patients the possibility of the existence of malignant disease at the back of the mouth must not be overlooked. Owing to the firm closure of the jaws, it may be quite impossible to make a satisfactory examination of the mouth, and to see or feel the growth. Careful examination from the outside in the neighbourhood of the angle of the jaw may, however, lead to the detection of deep-seated induration indicative of malignant disease. Or the presence of enlarged glands in this situation may point in the same direction.

After the muscles and other soft parts have been carefully examined and no cause for the closure has been detected, the temporo-maxillary articulation may be examined. The cause of closure of the jaws is, however, rarely in this part. An acute suppurative arthritis due to injury or to extension of suppuration from the

ear, or the subacute and chronic forms of arthritis due to tubercle, gout, rheumatoid arthritis, &c., generally present but little difficulty in diagnosis.

Closure of the jaws due to the mechanical hindrance of the movements of the lower jaw by large malignant and other tumours of the neck, requires no special mention. The closure of the jaws that is one of the earliest symptoms of tetanus is scarcely likely to be confused with any of the preceding affections.

It is important to remember that inability to open the mouth is not a very uncommon manifestation of hysteria. The age, sex, and manners of the patient, together with complete absence of any signs of local disease, are usually sufficient to raise a suspicion as to the nature of the complaint, and a little judicious conversation on the part of the surgeon will generally succeed in betraying the patient into opening his (or, more probably, her) mouth.

CHAPTER VII.

DISEASES OF THE TONGUE AND FLOOR OF THE MOUTH.

General enlargement of the tongue is caused by acute inflammation (glossitis), usually secondary to a wound or to an ulcer of the tongue itself or of a neighbouring part. Any inflammatory swelling in the neighbourhood of the mouth may lead to glossitis. The diagnosis of an acute glossitis is made by the presence of the usual signs of inflammation. The recognition of the cause is important, and it is well also in dealing with any case of glossitis to notice the condition of the breathing, and to remember that the inflammation may readily spread to the larynx and set up an acute œdema.

Chronic enlargement of the tongue is seen occasionally in young children (macroglossia), and is then due probably in the main to lymphatic obstruction. The surface of the tongue in such cases is usually rough, and may show dilated lymphatics.

The slight amount of general enlargement of the tongue which occurs in myxœdema and other diseases, and which is only a part of a general swelling affecting many parts of the body, need only be mentioned.

Syphilitic disease in the form of gumma may cause

considerable enlargement, which may be general, but is more often localised to one or other side. It is usually diagnosed by the presence of easily recognised signs of syphilis upon the surface of the tongue and elsewhere.

A deceptive appearance of enlargement of the tongue may be produced when the tongue is pushed upwards from below by inflammation (abscess) or tumour (dermoid cyst) in the floor of the mouth. A careful examination with one finger on the floor of the mouth and another under the chin will lead to the detection of the sublingual swelling.

An inflammatory swelling on the floor of the mouth on one side only may push the tongue over towards the sound side. Such a swelling is more likely to be due to a salivary calculus than to anything else. A ranula produces a similar effect.

Diminution in the size of the tongue, apart from injury, is rarely seen except as the result of paralysis of a hypoglossal nerve. If this be unilateral, as it usually is, the tongue is not only greatly atrophied on the affected side, but when protruded it deviates to the same side. The diagnosis is that of affection of the hypoglossal.

Difficulty in protruding the tongue is generally due to some affection of the floor of the mouth, either inflammation or new growth. The most common is carcinoma. Another cause of inability to protrude the tongue is the congenital defect known as tongue-tie; slight degrees of this affection are common, but severe degrees are distinctly rare.

It need scarcely be said that the condition of the surfaces of the tongue as regards colour, moisture, fur,

roughness, &c., affords valuable indications as to the condition of the general health.

Quite apart from these, however, are various local affections of the surface, which indicate local disease.

Ulceration of the Tongue.

Superficial shallow ulceration of the tongue is generally indicative of syphilis. Such superficial glossitis results in loss of epithelium, and the tongue acquires a patchy glazed appearance, which is very characteristic of that disease. Shallow ulcers of the tongue occur also in connection with dyspeptic conditions, and also as the result of irritation from bad teeth. In either case the ulcer is usually well defined and circular, and it is also very likely to be surrounded by a well-marked circle of redness. Such ulcers are usually attended by a good deal of pain. Dyspeptic ulcers are apt to be multiple, and to occur on various parts of the cheeks, lips, &c., as well as on the tongue. Dental ulcers are found naturally at the side of the tongue in contact with the offending rough tooth. Occasionally a simple ulcer caused by the irritation of a jagged tooth becomes so large, and is surrounded by so much inflammatory induration, that a suspicion of cancer may be roused, especially if the ulcer be somewhat chronic in its course. It is generally easy to tell by the absence of characteristic well-defined induration that we are not dealing with the more serious disease. Removal of the offending tooth, the frequent application of some simple mouth wash, and the delay of a few days, will in a doubtful case settle the diagnosis. Sometimes it is desirable to remove a small piece for microscopic examination.

A single large ulcer of the tongue is usually either syphilitic, tuberculous, or epitheliomatous. A primary syphilitic sore of the tongue is a rare disease; it occurs usually at the tip, and if the possibility of its being syphilitic does not occur to the mind of the observer, it may very easily be mistaken for an epithelioma on account of its indurated base. The resemblance to epithelioma is heightened by the induration and enlargement of the adjacent lymphatic glands. Careful attention to the history, to the situation, and to the flatness and circularity of the ulcer, and to the age of the patient, usually suffices for the diagnosis.

Single tertiary syphilitic ulcers caused by the breaking down of gummata usually are deeply excavated, have undermined edges, and present very little surrounding induration. The presence of other manifestations of syphilis on the tongue and elsewhere generally make the diagnosis sufficiently obvious.

Tuberculous ulcers occurring, as they usually do, in persons who are the subjects of well-marked pulmonary, laryngeal or facial tuberculosis, seldom present any difficulty in diagnosis. When a tuberculous ulcer occurs in an elderly person who is not obviously tuberculous, considerable difficulty in diagnosis may arise, and such an ulcer is not unlikely to be mistaken for epithelioma. Both the primary ulcer and the glands, if enlarged, lack the characteristic induration of epithelioma; the edge is apt to be undermined and the surface to secrete more pus than does an epithelioma. Bacteriological investigation, or microscopic examination of an excised bit of the ulcer, or even injection of some of the secretion into a guinea-pig,

may occasionally be necessary before the diagnosis can be made with certainty.

Epithelioma is to be diagnosed by the evidence of (i) local infiltration, and (ii) involvement of neighbouring glands.

It is scarcely possible, however, to lay too much stress upon the fact that the second of these conditions, the involvement of glands, indicates a comparatively late stage of the disease. Unfortunately, epithelioma of the tongue when first brought under our notice has only too frequently already caused palpable implication of glands. Nevertheless, it is in the earlier stage, before the glands are evidently affected, that the diagnosis ought to be made, if treatment is to be really efficacious. In the vast majority of cases the diagnosis can be made, and should be made, by careful attention to the local characters of the primary affection. To wait until glands are obviously affected before making a diagnosis of epithelioma of the tongue often means to inflict an irreparable injury upon the patient, and the practice cannot be too strongly condemned.

The really important part of the subject is therefore the diagnosis of the early stage from the local signs, at the time when treatment may reasonably be expected to be of great value to the patient.

The epitheliomatous ulcer is an ulcer on the top of a mass of new growth, and it is the existence of this mass in the tongue which gives the clue to the diagnosis. A well-defined hard base is characteristic of epithelioma. This hardness may be simulated by that of a primary syphilitic sore (see above), and in some rare cases by inflammation around a syphilitic or perhaps even a

simple ulcer. The hardness of mere inflammation is, however, not so definite as that of epithelioma.

Microscopic examination of an excised portion is a most valuable aid to diagnosis, and may afford the only certain means of arriving at a correct conclusion. Observation of the effect of the administration of iodide of potassium is occasionally useful in diagnosis, but only too often this method leads to loss of valuable time.

In some cases of epithelioma there is much outward overgrowth of tissue, in the form of a cauliflower-like mass. Such cases are sometimes mistaken on the one hand for simple papillomata, on the other hand for syphilitic or other granulomata. The presence of an indurated base, or, if necessary, microscopical examination of a portion of the tumours, afford the best means of diagnosis. It should be remembered that in elderly people simple papillomata, especially if growing rapidly, are apt to pass into a condition of epithelioma. They should be viewed, therefore, with much suspicion, and if any doubt as to the real nature exists, it is well to remove the growth and examine microscopically.

The various other innocent tumours that are found upon the tongue, such as lymphangiomata, nævi, and rarely fibromata, do not present any difficulty in diagnosis.

CHAPTER VIII.

DISEASES OF THE PALATE.

Congenital affections of the palate (cleft palate) seldom present any difficulty in diagnosis. Occasionally destruction of a portion of the palate from injury or from syphilis produces a condition resembling at first sight a congenital cleft. In these non-congenital cases, however, the cleft is rarely exactly in the middle line, the uvula is never divided into two parts, and there is always scarring at the margins of the cleft. A congenital cleft palate in which an unsuccessful operation has been followed by scarring and loss of tissue from sloughing may occasionally, in the absence of any reliable history, resemble a traumatic or syphilitic cleft sufficiently closely to lead to error. Ulceration of the palate, if superficial, does not differ essentially from that of other parts of the oral mucous membrane.

Deeper ulceration may depend upon disease of the bony palate, in which case it is likely to be due to tuberculous or syphilitic disease of the bones, or to necrosis from some other cause.

An inflammatory swelling in the centre of the palate is more likely to be due to syphilis than to any other cause, and has to be diagnosed by signs and symptoms of syphilis elsewhere. Tuberculous swellings are less

common, and the diagnosis is made in a similar manner. The condition of the teeth should always be carefully investigated in any case of inflammatory swelling about the palate, especially if the swelling be at the margin of the palate near the alveolar border. A swelling in the centre of the palate, away from the teeth, is much more likely to be a gumma than an alveolar abscess. Alveolar abscess is far more common on the outer than on the inner surface of the alveolus. In the case, however, of the upper central incisors the inflammatory swelling caused by caries often occurs on the palatine side of the alveolar margin. It is not unlikely that it will be in the middle line, and even at a little distance from the teeth. Such a swelling is often mistaken for a gumma, especially if care be not taken to examine the posterior surface of the incisor teeth with a dental mirror.

Of innocent tumours of the palate there is but one that is at all common, namely, the adenoma, springing from the submucous palatine glands. It is easily diagnosed by its prominence, definition, slight nodularity, and by its history of slow growth.

Of malignant tumours by far the commonest is the epithelioma, recognised by the ordinary characters of that disease. Sarcomata occasionally occur in the palate. They are likely to be mistaken for inflammatory swellings such as gumma. Growths, both sarcomatous and carcinomatous, originating in the upper jaw or elsewhere away from the palate, often extend downwards and inwards to the palate, and cause local bulging, which may be at first sight mistaken for primary disease of the palate.

CHAPTER IX.

DYSPHAGIA.

Difficulty in swallowing, or dysphagia, may be due to various causes, of which the principal may be grouped as follows :

Mechanical obstruction inside the mouth, pharynx, or œsophagus, *e.g.*, an impacted plate of false teeth.

Mechanical pressure upon these parts from the outside, *e.g.*, a tumour of the neck pressing upon the pharynx, an aneurism of the descending aorta compressing the œsophagus.

Mechanical obstruction due to disease in the wall of the pharynx or œsophagus, usually new growth or inflammation, or the scarring resulting from the latter.

Nervous and muscular causes, such as paralysis of the muscles of the pharynx, spasm of muscles (*e.g.*, in tetanus), and hysteria.

Methods of Examination.

The examination of any case of dysphagia of which the cause is unknown should include the following :

1. **Examination of the neck from the outside,** special attention being paid to the pharynx and

œsophagus. By rotating the larynx axially, its posterior surface can often be examined fairly thoroughly. Deep palpation at the root of the neck just above the sternum will often reveal the existence of a primary carcinoma of the œsophagus, or of a nodule of carcinoma secondary to a growth situated lower down.

2. **Examination of the chest,** both back and front, should be made in the ordinary way. Dysphagia may be produced by pericardial or pleural effusion, by intra-thoracic growths, and by various other diseases, the diagnosis of which usually concerns the physician rather than the surgeon. Auscultation of the back while the patient is drinking is sometimes of value in the detection of a stricture of the œsophagus, the normal short sound being replaced by a rushing, gurgling noise as the liquid passes the stricture.

It is well to remember that examination of the front of the chest does not throw any light on the question of the presence of aneurism as a cause of dysphagia. Aneurisms of the first and second parts of the arch, which are those most easily detected by physical examination, are not those that produce dysphagia. Aneurisms which cause dysphagia are those of the descending aorta. These, if they can be diagnosed at all by physical examination, are to be detected only by examination of the back.

3. **Examination of the interior of the mouth and pharynx** visually with a good light. The finger and probe may also be useful in examining these parts. The lower parts of the pharynx and the back of the tongue and larynx should also be carefully examined by means of the laryngoscope. Disease of the larynx itself is a frequent cause of dysphagia. This symp-

tom is often the earliest and most prominent feature of some forms of laryngeal disease, *e.g.*, tuberculous laryngitis.

The laryngoscope may reveal the cause of dysphagia (*a*) by showing disease of the pharynx itself, *e.g.*, an epithelioma at the back of the cricoid or elsewhere about the pharynx; (*b*) by showing disease of the larynx, such as tuberculous disease or other inflammatory conditions; (*c*) by showing paralysis of a vocal cord, which may be due to some affection of the œsophagus involving one or other recurrent laryngeal nerve. Carcinoma of the œsophagus is the most common cause of such paralysis associated with dysphagia, but occasionally inflammatory affections such as abscess close to the œsophagus, or even aneurism, may cause it.

The laryngoscope occasionally affords visible proof of the presence of a carcinoma of the œsophagus when the growth can be seen penetrating the trachea.

4. **Examination of the œsophagus from within** must be made instrumentally by bougies, and occasionally by the œsophagoscope.

Œsophagoscope.—This instrument is not of much practical value, as it is very difficult to insert a straight tube into a passage so curved as that which is formed by the mouth, pharynx, and œsophagus. Moreover, the risk of doing damage by lacerating surrounding parts is considerable. Finally, even if a good view of the œsophagus be obtained, it is not always easy to learn more about the morbid condition than can be learnt by much simpler means of diagnosis.

Bougies.—These may be made of gum elastic webbing, of catgut, or of other flexible materials. They are used to ascertain the presence of narrowing of the

œsophagus and to a certain extent to gauge the degree of that narrowing.

In passing a bougie the patient should crane his head forward, not extend it backwards. The entrance of the bougie into the œsophagus is then facilitated. The point impinges at first against the posterior wall of the pharynx, but can be guided into the right direction by the left forefinger introduced into the back of the mouth.

In passing an œsophageal bougie the greatest care should be exercised lest the point of the instrument be passed through the diseased wall of the œsophagus. This can easily be done in a case of carcinoma or of aneurism.

The commencement of the œsophagus, at the lower border of the cricoid cartilage, is, in a person of average size, at a distance of seven inches from the front teeth. The lower end is some nine or ten inches lower down, that is sixteen or seventeen inches from the teeth.

An œsophageal bougie is often arrested at the level of the upper border of the cricoid some six inches from the teeth, and care should be taken lest diagnosis of stricture at this point be made upon insufficient grounds.

5. **Examination by X-rays** is sometimes of service in ascertaining the cause of dysphagia. It is chiefly useful in determining the situation of metallic foreign bodies in pharynx or œsophagus. It is also occasionally useful in the detection of aneurism of the aorta, caries of the spine, &c.

Important evidence of considerable œsophageal stricture (malignant or otherwise) is obtained from the presence of glairy saliva which collects in the patient's

mouth or hangs from his lips. The saliva, which normally passes in considerable quantity into the stomach, is prevented by the stricture from doing so, and consequently collects above the stricture and regurgitates into the mouth. Although most often seen in cases of malignant stricture, it is not pathognomonic of malignancy, but only of obstruction.

Blood-stained expectoration may be seen in some cases of extensive ulcerative disease of the pharynx or œsophagus. It is especially apt to occur after local examination has been made with finger or bougie. Marked tendency to hæmorrhage indicates a friable surface of ulceration and often means epithelioma. But many, indeed most, cases of malignant disease of the œsophagus show no sign of blood unless irritated by rough attempts to pass bougies.

Apart from the various acute affections of the mouth, throat, and neck, which usually present no difficulty in diagnosis, the commonest and most important cause of dysphagia is malignant disease (epithelioma) of the œsophagus. When a middle-aged or elderly person complains of dysphagia, which has existed for a few weeks or months without any other marked symptoms, the existence of a carcinomatous stricture should be strongly suspected. If the passage of a bougie indicates the presence of an obstruction, the diagnosis is strengthened. Certain signs of epithelioma may also be present. If the growth be quite high up in the œsophagus, it may be felt as a small hard mass behind the trachea. Or hard glands may be felt in this situation, indicating malignant disease lower down. Paralysis of one or other vocal cord is also common in connection with epithelioma involving the upper part

of the œsophagus, that part, namely, which is in contact with the recurrent laryngeal nerves.

Progressive emaciation and weakness are also common in cases of carcinoma of the œsophagus. They are, however, not necessarily present in the earlier stages, and are not essential for the diagnosis. Indeed a man with carcinoma of the œsophagus may at first appear to be in robust health. Emaciation and weakness may be present, on the other hand, in cases of innocent stricture. In this case they are due to starvation from the mechanical hindrance to the passage of food into the stomach.

Innocent stricture of the œsophagus can scarcely be diagnosed in the absence of a history of injury (usually the swallowing of some corrosive), or a history that the dysphagia has existed for a very long time. It may be suspected in cases in which the general nutrition of the body is better than the duration of the symptoms would warrant on the supposition that the disease was malignant.

A congenital pouch of the pharynx or œsophagus may be diagnosed by two symptoms commonly present. The patient vomits or regurgitates *undigested* food that he has swallowed some little time, perhaps some days, before. The passage of a bougie into the stomach is sometimes impossible, sometimes quite easy, according as the point of the bougie enters the pouch or remains in the œsophagus. Sometimes the patient can himself empty the pouch when it is in the neck by pressing upon it with his fingers.

The history of the symptoms in a case of congenital pouch of the œsophagus generally extends over many years.

The very rare innocent tumours of the pharynx and œsophagus can seldom be diagnosed with certainty unless they can be seen or felt with laryngoscope or finger.

Of the various causes of dysphagia associated with diseases of the nervous and muscular system but little need be said. Such diseases as tetanus and hydrophobia are easily recognised by symptoms other than the dysphagia. Paralytic affections are recognised by the history, as in diphtheritic paralysis, or by the presence of other symptoms of disease of the nervous system, as in glosso-labio-laryngeal paralysis.

An important cause of dysphagia which must be mentioned here is hysteria. Trouble in swallowing is one of the ordinary manifestations of this Protean disease. In a young person it is likely to be mistaken for the beginning of some such disease as tuberculous laryngitis. In an elderly person it may be extremely difficult to diagnose from carcinoma of the œsophagus. It is, of course, much more common in women than in men. The character of the patient, the presence of other symptoms of hysteria, and the negative evidence of disease obtained by the passage of a full-sized bougie into the stomach, are usually sufficient for the diagnosis.

CHAPTER X.

DISEASES OF THE LARYNX.

History.—The larynx is an organ that serves the twofold function of producing voice and transmitting air to the lungs. From the close connection of the larynx with the pharynx, laryngeal diseases, and especially those of an inflammatory nature, are likely to interfere more or less with the satisfactory performance of the act of deglutition. It is obvious, therefore, that in ascertaining the history of a case of supposed disease of the larynx special attention should be directed to the manner in which these three functions of phonation, respiration, and deglutition have been performed.

Disease of the larynx may be purely local, or, on the other hand, it may be but a local sign of some general disease, such as tuberculosis, renal disease, or some specific fever.

Tuberculous laryngitis occurring as a complication of pulmonary phthisis, œdema of the larynx due to Bright's disease, and laryngitis in the course of typhoid fever, may be cited as examples.

The laryngeal affection may also be but a local manifestation of a disease affecting some more or less distant part directly connected with the larynx by means of one or other of the laryngeal nerves.

Thus, superior laryngeal paralysis may be a sign of that disease of the medulla known as glosso-labio-laryngeal palsy, or paralysis of a vocal cord may be the laryngeal sign of thoracic aneurism, of carcinoma of the œsophagus, or of some other local disease affecting the recurrent laryngeal nerve at a distance from the larynx itself.

The importance of directing attention to the condition of other parts of the body, and especially to the lungs and kidneys, is therefore obvious.

Symptoms of Laryngeal Disease.

1. **Phonation.**—Anything which interferes with the free and natural movements of the cords, or alters their tension, or which causes roughness of their delicate edges, will lead to alteration of the voice (dysphonia). The most common alteration is in the direction of hoarseness, as seen in simple catarrhal laryngitis, or in the case of a tumour growing from the cord, or when a cord is fixed and unable to move. A squeaky, high-pitched voice may, on the other hand, be the result of some increase in the tension of the cord. Diminution of the normal tension of the cord leads, on the other hand, to a lower pitch of voice, as in the case of paralysis of the superior laryngeal nerve.

Aphonia, or loss of voice, may result either from inability to move the cords, as in severe forms of laryngitis, or from their destruction from ulceration, or may merely be a manifestation of hysteria.

2. **Respiration.**—Anything which obstructs the free flow of air through the larynx naturally tends to cause difficulty in breathing (dyspnœa). The obstruc-

tion may be caused by swelling of some portion of the larynx itself (as in œdema of the larynx, laryngitis, gumma, or new growth); by temporary or permanent approximation of the vocal cords to one another (spasm of the glottis, abductor paralysis); or by the presence of some foreign body in the cavity of the larynx (a foreign body introduced from without, such as a piece of bone, or formed within the larynx, such as diphtheritic membrane). Frequently two or more of these causes are combined, as in the case of diphtheria, causing laryngeal inflammation and swelling, and also obstructing the larynx with membrane; or when a piece of bone in the larynx sets up laryngitis.

3. **Deglutition.**—Any painful affection of the larynx is likely to cause difficulty in swallowing (dysphagia), because of the painful movement of the larynx thereby occasioned. A swelling of the posterior part of the larynx, such as that produced by necrosis or perichondritis of the cricoid cartilage, may also cause dysphagia by producing a mechanical obstruction. So also may a malignant tumour which has extended beyond the confines of the larynx itself.

An old aphorism, dating from before the days of the laryngoscope, says that difficulty of swallowing for which no adequate cause is visible in the fauces, followed by difficulty of breathing for which no adequate cause can be discovered in the thorax, indicates acute laryngitis.* Painful deglutition is often one of the most prominent symptoms of laryngeal tuberculosis.

* Watson, "Principles and Practice of Physic," vol. i. pp. 864–5.

Physical Examination.

Examination of the **exterior** of the larynx from the neck occasionally affords useful information, and should never be omitted.

Various inflammatory affections of the larynx, such as perichondritis and necrosis of the cartilages, may cause a general or local thickening of the soft tissues outside the larynx, giving the impression that that organ is larger than it really is. Tumours of considerable size within the larynx may cause an expansion of the wings of the thyroid cartilage, which can easily be felt from the outside. In its later stages a malignant tumour may extend to the exterior of the larynx and be accessible to direct external examination. Chronic inflammatory affections of the larynx such as tubercle frequently extend to the exterior of that organ, producing inflammatory œdema or abscess of the cellular tissue in the immediate neighbourhood of the larynx. The cervical glands, too, may be involved in tuberculous and other diseases of the larynx.

Examination of the **interior** of the larynx is conducted almost entirely by means of the laryngoscope. Examination by the finger is occasionally useful in the detection of diseases involving the upper part of the larynx, such as the epiglottis, aryepiglottidean folds, and arytenoid cartilages. The rare congenital malformation of the epiglottis and the common inflammatory swelling of the aryepiglottidean fold may be detected in this way. In children especially are these parts easily accessible to the examining finger. The introduction of a laryngeal probe is sometimes of use in

determining the mobility or otherwise of an intra-laryngeal growth.

Before proceeding to the examination of the larynx itself with the laryngoscope, it is well to make a careful and thorough inspection of the mouth, tongue, pharynx, and neighbouring parts, since disease in these parts may afford valuable indications as to the nature of the laryngeal affection. Thus the nature of an otherwise obscure ulceration of the larynx may be indicated by the presence of typical tuberculous, syphilitic, or other disease of the tongue or pharynx.

Examination of the fossæ in the immediate neighbourhood of the larynx (glosso-epiglottic fossæ), and of the pharynx behind these, may reveal the presence of some primary disease which has extended to, and thus caused, disease of the larynx.

In order to make a proper laryngoscopic examination, spraying or painting of the throat with cocaine may be necessary in the case of nervous or very sensitive patients. In the case of young children, the employment of a general anæsthetic is often essential.

In examining the interior of the larynx, attention should be directed to

(i) The mucous membrane, whether congested, ulcerated, or scarred.

(ii) The submucous tissue, whether œdematous or the seat of any other local or general swelling.

(iii) The vocal cords, as regards their position and movements.

(iv) The presence of any structure within the cavity of the larynx, either a foreign body, or some out-

growth from the larynx itself—a tumour, innocent or malignant.

(i) **Mucous membrane.**—Congestion or inflammation of the larynx produces a general vascularity of the larynx which is best seen on the true vocal cords. These lose their normal pearly white colour and become more or less reddened.

Hoarseness of the voice is the corresponding symptom caused by this alteration in the condition of the vocal cord.

Chronic inflammation of the larynx causes the usual appearances seen in mucous membranes which have been subjected for a long time to irritation and inflammation. The membrane becomes thickened, roughened, altered in colour, and often presents minute but distinct patches of local overgrowth of epithelium. In extreme cases prominent warty growths may be seen. These changes are found on both sides of the larynx, and are usually symmetrical. The region of the vocal cords is that in which the changes of simple chronic laryngitis are most marked.

A granular condition of the mucous membrane is suggestive of an early stage of tuberculous disease, especially if numerous minute yellow granules (tubercles) can be seen. At a somewhat later stage of the same disease these little granules have broken down into ulcers.

Shallow ulcers are common also in the severer forms of simple laryngitis, such as that occurring in the later stages of various specific fevers.

Scarring.—Minute superficial scars may be merely the result of shallow superficial simple ulcers. Scarring, the result of healed tuberculous ulceration,

is not at all common, since tuberculous ulceration is usually progressive, and has not much tendency to heal.

Extensive scarring, especially when accompanied by much destruction of the epiglottis or the other deeper parts of the larynx, is highly suggestive of syphilitic disease.

(ii) **Submucous tissues.** — The more severe forms of inflammation, whether acute or chronic, affect the adjacent submucous cellular tissue as well as the mucous membrane itself. Swelling of the cellular tissue may also be caused by simple œdema due to Bright's disease. But œdema of the larynx in the vast majority of cases is due to local inflammation. This œdema may be caused by local injury, such as inhaling steam, drinking hot or corrosive liquids; by spread of inflammation from surrounding parts, as in the case of œdema of the larynx, secondary to some ulcer of the tongue or pharynx; by the presence of some ulcer within the larynx itself. A septic condition of any ulcer, whether simple, tuberculous, syphilitic or malignant, is sufficient to cause surrounding œdema.

Sometimes the œdematous area is visible when the ulcer which is the cause of it is out of sight, being hidden by the swelling.

Œdema naturally most readily affects that part of the larynx in which the cellular tissue is most lax and abundant, that is, the upper part, and especially the aryepiglottidean folds. The submucous tissue of the epiglottis, of the interarytenoid fold, and of the false cord are affected to a lesser degree. Œdema of the larynx never extends below the true vocal cords,

because the mucous membrane is firmly attached to those structures; this attachment limits its downward spread. The rapidity with which œdema of the larynx may occur, and the suddenness with which it may cause very serious and even fatal dyspnœa, are well known. Œdema of the larynx must always be regarded as a sign of serious import, and one upon which a careful watch must be kept.

The swelling caused by œdema of the larynx is often so great that the interior of the larynx is largely or even wholly hidden from view. Especially is the view of the interior of the larynx obscured when the œdema is unilateral, and when in addition to the œdema there is marked displacement of the larynx as a whole (as by a tumour in the neck).

A subacute or chronic swelling of any part of the larynx may indicate not merely superficial œdema, but the presence of some more serious deeply-seated disease. Thus a pyriform swelling of the arytenoid and aryepiglottidean region frequently indicates tuberculous disease of those parts.

In every case of inflammation and ulceration of the larynx an attempt should be made to ascertain the cause of the trouble. This must be done not merely by the local characters of the laryngeal disease, which are often not sufficiently marked to be pathognomonic, but by examining for evidence of disease elsewhere. Tubercle and syphilis, for instance, both of which are common causes of laryngeal ulceration, may have to be diagnosed not so much from the characters of the laryngeal affection, as from the history or the presence of more characteristic lesions in other parts of the body.

The examination of the sputum for tubercle bacilli affords important help in the diagnosis of tuberculous laryngitis.

(iii) **The vocal cords.**—Observation of the vocal cords as regards their position and movements forms an important part of a laryngoscopic examination.

Displacement of both cords together to one or other side of the middle line usually indicates displacement of the larynx as a whole; examination of the neck from the outside will confirm this. Displacement of both cords without displacement of the larynx as a whole may occur, to a certain extent, in some rare cases, from the pressure of a tumour upon the arytenoid cartilages. Forward displacement of one arytenoid cartilage and accompanying shortening of the corresponding vocal cord is a very common condition, and indicates paralysis of that cord. The cord in such a case lies in the cadaveric position, that is, midway between abduction and adduction. It is immobile.

The movements of a vocal cord may be restricted or entirely prevented by

(*a*) Paralysis of its nerve-supply.

(*b*) Inflammation affecting subjacent tissues, especially the intrinsic muscles and crico-arytenoid joint.

(*c*) Malignant new growth.

(*a*) **Paralysis** of the superior laryngeal nerve is very rare. Supplying only the cricothyroid muscle, this nerve when paralysed prevents the cord from being stretched in the utterance of high notes. The voice consequently tends to be a low bass one.

Since this nerve is also the sensory nerve to the

mucous membrane of the larynx, its paralysis is accompanied by anæsthesia of the upper part of the larynx. This condition is detected either by direct examination or by the history that particles of food easily pass into the larynx or beyond it, and set up irritation in these parts.

Paralysis of the inferior or recurrent laryngeal nerve is far more common. Being the principal motor nerve to the larynx (supplying all the intrinsic muscles except the cricothyroid) its paralysis affects both abductors and adductors of the cords. The cord consequently assumes the cadaveric position, and is immobile.

It is important to remember that when this nerve is slowly losing its function, the abductors of the cord are paralysed sooner than the adductors. Consequently the cord at first assumes the position of adduction, and only subsequently, when the paralysis is completed, takes up the cadaveric position. If both recurrent nerves are partially paralysed to an equal extent, which, however, rarely happens, both cords lie in the adducted position, *i.e.*, close together. In such a case there is great inspiratory dyspnœa with stridor, and the patient is in imminent danger of being suddenly suffocated.

As a rule, when both recurrent nerves are paralysed, one is affected before the other. Consequently, the cord on one side has become completely paralysed, and has assumed the cadaveric position before the other has become adducted. Sufficient space is thus left between the cords for breathing purposes. When the second cord has too in its turn become completely paralysed, still more space is given for the passage of air.

(*b* and *c*) The infiltration by **inflammatory products,** or by **new growth** in the tissues in the immediate neighbourhood of the cord, naturally tends to cause a mechanical fixation of the cord. The immobility thus caused is, however, seldom so marked as in the case of genuine paralysis.

Fixation of the cricoarytenoid joint by inflammation of any kind naturally has an injurious effect upon the movement of the cord, attached as it is posteriorly to the arytenoid cartilage. The importance of fixation of the cord in the diagnosis of early malignant disease will be discussed later (page 102).

(iv.) The **obstructions that occur within the cavity of the larynx,** and which tend to block it up, are—

1. Foreign bodies.
2. Projections from the wall of the larynx.
   (*a*) Inflammatory (granulomata).
   (*b*) Papillomata, fibromata, and other innocent new growths.
   (*c*) Malignant new growths (carcinoma, very rarely sarcoma).

1. **Foreign bodies.**

Except in the case of very young children, the diagnosis of a foreign body is generally easily made. The history of a very sudden onset of violent paroxysmal dyspnœa, followed by more or less constant dysphonia and dyspnœa, and the result of laryngoscopic examination, are generally sufficient for a correct diagnosis. The definite history of a foreign body having been in the mouth immediately before the onset of the attack may possibly be given.

In some cases, however, a characteristic history is

wanting ; in others the laryngoscopic examination may fail to reveal the presence of the foreign body. In the case of young children, a foreign body may easily be mistaken for, or simulated by, laryngeal diphtheria having an apparently sudden onset, or even by the presence of a papilloma. The difficulty of making a thorough laryngoscopic examination in a child adds to the difficulty of diagnosis. Even if a good view of the larynx be obtained, the presence of the foreign body may be overlooked owing to its small size, or to its being covered over with mucus or hidden by inflammatory swelling. In such cases the use of a probe may help in detecting the presence of a hard foreign body.

Sometimes tracheotomy or thyrotomy may become necessary before the diagnosis is conclusively established.

2. Projections from the wall of the larynx.

(*a*) **Granulomata** occur either in the course of some specific disease such as syphilis, or they are due to some deep-seated source of irritation such as necrosis of cartilage or a foreign body embedded in the tissues. They may be very difficult to distinguish, except by the history, from some new growths. The presence of much suppuration would indicate the presence of dead bone or other foreign body.

(*b*) Papillomata, fibromata, and other **innocent new growths,** have to be distinguished on the one hand from inflammatory swellings, on the other from malignant new growths.

Innocent new growths such as fibromata often have a polypoid shape ; any pendulous mass with a narrow pedicle is likely to be an innocent new growth.

Papillomata, when they assume a villous appearance,

as they often do, are not difficult to recognise. Papillomata are not uncommon in young children at an age when malignant disease is practically unknown. Papillomata are frequently multiple and occur on both sides of the larynx; this is uncommon with malignant disease.

(*c*) **Malignant disease** when taking the form of a sarcoma, which is very rare, appears as a rounded lump beneath the mucous membrane. This gradually increases in size, displacing surrounding parts and causing more and more dysphonia and dyspnœa. At first it is not ulcerated, and is most likely to be mistaken for a gumma or some other inflammatory swelling.

The only common form of malignant disease of the larynx is the squamous carcinoma (epithelioma). The symptoms of this disease vary considerably according to the situation in which the disease is found.

Extrinsic carcinoma is very commonly seen at the margin of the upper opening of the larynx, spreading thence into the larynx itself. This disease appears as a well-defined, raised, ulcerated mass, with a flattened or roughly granular surface.

The situation of the ulcer in the pharynx naturally causes pharyngeal symptoms (*i.e.*, painful deglutition), rather than laryngeal ones. The action of the vocal cords is often unimpaired in the earlier stages of extrinsic carcinoma. Frequently, however, a malignant ulcer near the larynx exists for a considerable time without causing any marked symptoms, and the occurrence of laryngeal symptoms (difficulty in breathing) may first draw the patient's attention to his condition and lead him to seek advice.

The later stages of this disease are not difficult to diagnose, and are likely to be confounded only with the later stages of tuberculous or syphilitic ulceration occurring in middle-aged or elderly subjects.

Intrinsic carcinoma of the larynx in its earlier stages is frequently overlooked. This is a serious mistake, because in its earlier stages this form of cancer is very amenable to radical treatment, much more so than is the extrinsic carcinoma situated in the loose cellular tissue of the upper part of the larynx or pharynx.

Intrinsic carcinoma generally begins in the form of a small warty growth on one true vocal cord or at the junction of the cords in front. At this stage it produces no symptom other than hoarseness, and is generally attributed by the patient, and sometimes by his medical attendant, to "a cold."

A persistent hoarseness, occurring in a patient over forty years of age, and for which no cause is known, should invariably lead to a suspicion of malignant disease, and a careful laryngoscopic examination should at once be made. The patient's general health may be exceedingly good, and this very fact is apt to deceive and to lead to the idea that "there cannot be cancer." Much valuable time may thus be lost before the establishment of a certain diagnosis. Early diagnosis is all important in the successful treatment of intra-laryngeal cancer, a form of cancer the treatment of which, it may be remarked, is by no means unsuccessful, if only it is undertaken early, and carried out efficiently and thoroughly.

A laryngoscopic examination at this early stage will probably reveal a warty growth in one or other of the

above-mentioned situations, and the question then arises, "Is this innocent or malignant?" a question at first often very difficult to answer.

One of the most important points in the diagnosis at this stage is the mobility of the vocal cord on which the growth is situated. The **malignant growth infiltrates the underlying tissues,** and consequently leads to more or less fixity of the cord. Innocent growths have no such tendency.

In doubtful cases it may be desirable to attempt removal of a portion of the growth with endolaryngeal forceps or guillotine, in order to submit it to microscopic examination. It is not always possible even then, however, to pronounce with certainty as to the non-malignancy of a laryngeal new growth. If reasonable doubt still exists as to the diagnosis, thyrotomy may be performed.

In the later stages of malignant disease there is less difficulty in the diagnosis; the steady progress of the disease, the presence of a definite mass of growth, its tendency to ulcerate and perhaps to bleed, later still the affection of lymphatic glands and extension of the tumour beyond the larynx, all serve to render diagnosis easy.

Trachea.

A laryngoscopic examination may also be required for the examination of the trachea.

Under favourable conditions, the whole of the trachea as far as the bifurcation can be inspected. Displacement of the trachea, narrowing of its calibre by pressure from without or by contraction of scars from within, ulceration and new growths of various kinds,

may have to be investigated by the laryngoscope. Another method of examining the interior of the trachea consists in passing a straight tube through the larynx while the patient is under the influence of an anæsthetic. It is said that a good view of the trachea and even of the bronchi can thus be obtained. The mechanical difficulty and the danger of passing such a tube render this method, however, one of very limited applicability.

CHAPTER XI.

DISEASES OF THE THYROID GLAND.

For purposes of diagnosis diseases of the thyroid gland may be conveniently divided into two classes :

1. Those which cause diminution in the size of the gland (atrophy).

2. Those which cause enlargement.

1. Diseases causing diminution in the size of the gland.

The diagnosis here depends almost wholly upon the presence of general signs and symptoms of loss of function of the gland. The physical examination of the gland is of very little importance, since it is very difficult or impossible to say definitely from mere physical examination of the neck that the gland is absent or even much diminished in size. The two diseases characterised by loss of function of the gland are **myxœdema** and **cretinism,** both of which are produced by atrophy of its secreting elements.

The symptoms of both may be summed up briefly as follows :

Diminution in activity, both bodily and mental. Dull, heavy, facial expression, with sallow complexion, and often a pink flush on the cheeks.

Dryness and roughness of skin, and tendency to loss of hair.

Low temperature.

In many cases swelling of subcutaneous tissue, without true œdema.

In the case of cretinism, which is practically myxœdema occurring in early life, there is also marked arrest in the development both of body and mind.

In many cases of cretinism, and in a few cases of myxœdema, there is no diminution in the total size of the gland. This may even be enlarged, but in all cases there is atrophy of the glandular elements. Myxœdema is most likely to be mistaken for chronic renal disease, or for mere obesity.

Cretinism in its well-marked form seldom presents any difficulty in diagnosis, but may be mistaken for rickets and for some forms of idiocy. The diagnosis has to be made by attention to the characters mentioned above.

2. **Diseases causing enlargement of the thyroid gland.**

These are—

(1) Simple goître (of various kinds).
(2) Graves's disease.
(3) Inflammation.
(4) Malignant disease.

The two last are comparatively rare.

Any form of enlargement of the thyroid may be accompanied by slight signs of loss of function of the gland, such as pallor and mental hebetude ; but as a rule such signs are not prominent, and are of but little value in diagnosis. It is remarkable that in some cases of simple goître the gland may be so diseased as to preserve no visible trace of its normal structure, and yet be quite capable of carrying on its normal work.

Diagnosis of a Thyroid Swelling from other Swellings in the Neck.

There is usually but little difficulty in making the diagnosis. The situation of the swelling in the region of the thyroid and the fact that it moves up and down during the act of deglutition, are in almost all cases sufficient to prove its thyroid nature. There are, however, cases in which difficulties may arise.

These are:

(1) Cases in which a thyroid tumour does not occupy the normal situation of the thyroid.

Masses of thyroid tissue sometimes occur in outlying regions. These may be tumours of an accessory thyroid, or more often adenomata, which have been extruded from the gland and are attached to it by a more or less slender pedicle. In proportion as the tumour is more or less detached from the main gland, so does it tend to lose its characteristic sign of moving with the larynx on deglutition.

(2) Cases in which a thyroid tumour, occupying the situation of the gland, does not move during deglutition.

These are almost entirely cases in which the tumour has been fixed by inflammation or by infiltration of new growth to neighbouring fixed structures, such as the vertebræ, sternum, or sterno-mastoid muscles. In these cases the diagnosis has to be made partly by the shape and situation of the tumour, and partly by the special signs of inflammation or malignancy. Rarely simple thyroid tumours, not the seat of inflammation, are mechanically fixed and prevented from movement by being jammed in the upper opening of the thorax.

Such cases are usually, however, easily diagnosed by the history and by the severe dyspnœa to which they give rise. Sometimes it is difficult to distinguish such a tumour from an aneurism of the aorta.

(3) Swellings not of thyroidal origin may occupy the situation of the gland itself, and thus come to simulate thyroidal swellings.

These are chiefly small deep-seated swellings, springing from lymphatic glands, which have become secondarily adherent to the trachea and larynx. Dermoid tumours and other innocent new growths may also occasionally become adherent in the same manner, and thus follow the movements of the larynx and trachea. Chronic abscess and other inflammatory swellings originating in disease of the larynx (perichondritis and necrosis) may very closely resemble a thyroid swelling. Examination of the interior of the larynx will often afford material help in the diagnosis.

A malignant growth springing from the lower end of the pharynx or upper end of the œsophagus often forms a tumour of considerable size, which may present much resemblance to a thyroid swelling. When small and lying behind the thyroid lobe, it may push the latter forwards and so cause it to be unduly visible and palpable, as if it were itself enlarged. A larger mass may displace the lobe and come forward in its place between the sterno-mastoid muscle and the larynx or trachea.

Such growths may generally be distinguished—

(i) By the fact that the larynx and trachea can be displaced laterally away from the tumour, so that a finger may be laid between these structures. This can only very rarely be done in the case of a thyroid tumour

which is firmly attached by its ligament to the lower part of the larynx.

(ii) By observing the relation of the carotid artery to the swelling. Simple thyroid tumours tend to displace the artery outwards, or outwards and backwards. Malignant thyroid growths tend to envelop it or to lie in front of it. Malignant pharyngeal or œsophageal growths often displace the artery forwards or forwards and inwards. The situation of the carotid artery therefore in front of, or on the inner side of, a growth, affords a very strong presumption that the latter is not of thyroidal origin.

Large masses of new growth, originating in lymphatic glands and elsewhere, occasionally cover up and surround the whole of the larynx and trachea in such a manner as to make it difficult to say whether the thyroid is involved or not. The early history of such a tumour, its irregularity, the fact that it spreads far beyond the usual limits of a thyroid swelling, and does not preserve either the shape or the exact situation of a thyroid tumour, will, however, generally obviate any mistake in diagnosis.

Differential Diagnosis of a Thyroid Swelling.

A swelling which involves uniformly the whole thyroid gland presents usually but little difficulty in diagnosis. It is either a parenchymatous goître, or it is the goître of Graves's disease, or, rarely, if acute and recent, it may be simply an inflamed thyroid gland.

Acute inflammation involving the whole gland is easily diagnosed by the ordinary signs of inflammation.

The only other condition which is likely to be mistaken for it is the acute parenchymatous goître of young people. This sometimes enlarges very rapidly, and has often been mistaken for inflammation. The absence of severe pain and of elevation of temperature are important points in the diagnosis of acute non-inflammatory goître. Inflammation of the thyroid, too, is rarely seen, except as the result of injury or during convalescence from some specific fever, especially typhoid.

The disease known as chronic primary inflammation of the thyroid, in which the whole gland becomes slowly converted into a mass of very dense fibrous tissue, is so rare as not to require further consideration.

The diagnosis of the goître of Graves's disease in its well-marked form presents no difficulty whatever. The diagnosis is made, however, not so much by the examination of the gland itself, as by the presence of other characteristic signs of the disease, exophthalmos, rapidity of pulse, tremulousness, and excitability. The gland itself is usually somewhat smoother than that of a parenchymatous goître. Marked pulsation of the thyroid vessels is often seen in Graves's disease, but is in itself a somewhat fallacious sign, and is not to be relied upon.

It is well to remember that the enlargement of the thyroid of Graves's disease is always uniform and symmetrical. The only apparent exceptions to this rule are afforded by those cases in which the symptoms of Graves's disease supervene in persons who are already the subjects of a unilateral (cystic or adenomatous) goître. It is important to remember, too, that a somewhat rapid pulse is not uncommon in persons who are the subjects of simple goître. Mere rapidity of pulse

(unless very marked and persistent), and the presence of a goître, are not in themselves sufficient for the diagnosis of Graves's disease. It is not uncommon, however, for the diagnosis of Graves's disease to be erroneously made on these grounds alone.

Real difficulty in the diagnosis of Graves's disease occurs only in those early cases in which the general symptoms of the disease are ill-marked, and especially in those cases in which exophthalmos has not yet become apparent. The diagnosis in such cases has to be made partly by the characters of the pulse, but mainly by the nervous, fidgety manner of the patient, and her tremulousness and excitability. The lessened electrical sensibility of the skin and the presence of the lid signs, described by von Graefe and Stellwag, may perhaps help in the diagnosis, but are not, in my opinion, of much importance.

The later stages of a parenchymatous goître frequently show other characters due to the occurrence of small cysts or adenomata in the gland, or to the existence of much fibroid or calcareous degeneration. The latter may cause the tumour to be extremely hard, and may, in the absence of a reliable history, raise a suspicion of malignant disease.

A malignant tumour, however, which has progressed so far as to involve both lobes of the gland is almost certain to be fixed to surrounding parts, and is thus easily distinguished from the hard fibroid or calcareous goître which has no tendency to be so fixed.

A thyroid swelling which is limited strictly to one lobe of the gland is also, as a rule, not difficult to diagnose. With the exception of inflammation and malignant disease, both of which are

uncommon and usually have special characters of their own, a swelling involving only one lobe of the thyroid is an encapsuled tumour; either an adenoma or a cyst.

Such tumours, moreover, are almost always either oval or globular, and never preserve exactly the natural pyriform shape of the lobe. Multiple tumours in one lobe present naturally an irregular lobulated appearance.

The differential diagnosis between cysts and solid adenomata is frequently very difficult. Adenomata may be so soft as to give rise to an apparent feeling of fluid, and, on the other hand, cysts tensely filled with fluid and old cysts with thick, tough, fibrous or even calcareous walls, may be extremely hard. Many thyroid tumours are adenomata which have partly broken down and become cystic in the centre.

A very sudden and rapid enlargement of an encapsuled thyroid tumour generally indicates that it is a cyst; increased secretion or hæmorrhage into its interior causes the sudden enlargement.

Thyroid tumours are often present in the middle line of the neck, and appear to spring from the isthmus. Occasionally they do really come from this part of the gland. Much more often, however, a tumour in the middle line of the neck will be found to belong to the lower part of one or other lateral lobe, the trachea being displaced towards the opposite side. A large prominent median tumour of this kind occasionally simulates a general enlargement of the whole gland. A careful examination of the situation of the larynx and trachea will show that these are displaced to one or other side in the case of a tumour. Such displacement never occurs when the whole gland is uniformly enlarged.

The tumour, moreover, has a convex upper border; the uniformly enlarged gland has an upper border which is concave, or in which a central notch (or, if a middle lobe be present, two notches) can be felt.

Thyroid swellings which involve both lobes of the gland sometimes present difficulties in diagnosis. Encapsuled tumours of exactly equal size, occurring in both lobes, may be difficult to distinguish from a general enlargement of the whole gland. Careful attention to the shape of the tumours will, however, generally show that they are round or oval, and do not preserve exactly the shape of the normal lobe. Tumours, too, if bilateral, are rarely of equal size, and more than two are usually present. Multiple encapsuled tumours of considerable size present no difficulty in diagnosis. Many thyroid tumours are, however, associated with more or less general parenchymatous enlargement, and in such a case the tumour or tumours, if deeply embedded in a considerable mass of parenchymatous goître tissue, may escape detection.

Conversely it occasionally happens that a strictly parenchymatous goître presents a lobulated appearance which can easily be mistaken for that of multiple adenomata or multiple cystic disease.

Marked inequality in the size of a bilateral goître is almost pathognomonic of the presence of a tumour in the larger lobe.

Malignant disease of the thyroid gland in a well-marked form seldom presents much difficulty in diagnosis. If the capsule of the gland has been penetrated by the growth, the latter becomes adherent to surrounding structures; this is shown partly by the fixity of the tumour and partly by involvement of neighbouring

nerves, especially the recurrent laryngeal, the sympathetic and those of the cervical and brachial plexuses.

Paralysis of either of the two former and severe pain in the area of distribution of any of the latter are rarely caused by innocent goître, and should always raise a strong suspicion of the existence of malignant disease (or occasionally of inflammation).

It is in the earlier stage of the disease, before the capsule of the gland has been penetrated, that the diagnosis of malignant disease is so difficult. Indeed, a certain and positive diagnosis at this stage is generally almost impossible.

When, however, in the gland of a person over forty, a tumour appears which is hard, which steadily and rapidly increases in size, and which is not of an inflammatory nature, the malignancy of such a tumour should be strongly suspected.

If, moreover, thesurface of the tumour is irregular and bossy, and if there is likewise dysphagia and pain in the neck, shooting up to the side of the head or to the shoulders, then the diagnosis becomes almost a certainty.

Involvement of skin and lymph glands affords but little help in the diagnosis. The skin is seldom involved even in late stages, except in those cases in which the growth has been punctured or incised; exceptionally, spontaneous ulceration of the skin does however take place.

By the time that enlargement of the glands can be detected, the nature of the disease is usually sufficiently obvious; it must be remembered that the glands that first become affected are usually very deeply seated, at

the root of the neck, or behind the sternum, where their detection is well nigh impossible.

When malignant disease occurs, as it often does, in a gland that is already the seat of an innocent goître, the true nature of the affection is apt at first to be masked.

On the other hand, malignant disease may be simulated by the rapid enlargement of such a goître due to the development of a cyst, or to hæmorrhage into a cyst. A rapidly enlarging cyst is often attended by a certain amount of pain. It can generally be distinguished from a malignant tumour by its smoothness; generally also by its softness, although it must not be forgotten that tense cysts may be very hard, and that some forms of malignant disease are very soft.

Inflammation of a goître resembles malignant disease in that it causes pain, fixity and often involvement of neighbouring nerves, notably the recurrent laryngeal.

CHAPTER XII.

DISEASES OF THE BREAST.

A PATIENT who seeks advice with regard to an affection of the breast generally does so on account of one or other of the four following conditions:

(*a*) Pain. (*b*) Swelling. (*c*) Discharge from the nipple. (*d*) Some superficial affection of the skin, such as eczema, ulceration, &c.

(*a*) **Pain.**—Pain in a breast may be due to disease in the breast itself, or to disease in some adjacent part, or it may be merely a referred pain, the primary source of which is in some distant part. Pain due to local disease is usually accompanied by some other local sign, such as swelling or tenderness. Pain due to an affection of a neighbouring part, such as periostitis of an underlying rib, or inflammation of a pleura, has to be diagnosed by the other signs and symptoms of these affections, and by the fact that the breast itself, when lifted up or drawn gently away from the chest-wall, shows no evidence of disease.

It is well, however, to remember that even if the breast be obviously diseased, the pain complained of by the patient may, nevertheless, be due to some other cause. Thus a patient with a harmless adenoma may have severe pain, due, let us say, to pleurisy. A

little care will, however, in such a case, prevent any mistake.

We must avoid jumping too readily to the conclusion that a lump in the breast and a pain in the same part are necessarily associated in the relation of cause and effect. If a breast show no sign whatever of disease, and the patient, nevertheless, complains of pain in it, the most careful examination of the spine and chest-wall should be made, and the viscera of the thorax and abdomen investigated. Bilateral pain referred to the breasts is not likely to be caused by spinal caries. Pain in the left breast is frequently associated with disease of the stomach or heart. Pain in the right breast may be caused by disease of the liver.

In the vast majority of cases, however, a pain felt in a breast is due to disease of that organ.

Severe pain almost always indicates inflammation; the pain being especially severe if the inflammation is deep-seated and under tension, as in the earlier stages of mammary abscess. Tenderness associated with pain generally points to inflammation. A cyst which contains much fluid, and is consequently very tense, may also give rise to a good deal of pain. But in such a case as this it is generally a transient inflammation of the cyst wall that leads to increased secretion into the cyst and so to the pain.

The more chronic inflammatory affections of the breast may give rise to a certain amount of dull aching pain, which may be difficult to distinguish from the pain due to a malignant new growth. A pain which is felt only or chiefly towards the evening is likely to be due to inflammation.

New growths of the breast, if not inflamed, rarely

give rise to much pain. Innocent growths, such as adenomata and cysts, rarely cause pain, unless they are enlarging rapidly and exerting pressure upon surrounding parts.

Malignant growths tend, of course, to extend to the skin, or to the mucous surfaces of ducts, and thus easily become infected, inflamed, and consequently painful. By infiltrating and involving nerves they may at times give rise to a certain amount of pain. It is important to remember that it is the inflammation which is frequently the cause of pain in a new growth. Treatment, *i.e.*, cleansing with antiseptics, will often materially lessen the pain of an ulcerated new growth.

A slight amount of pricking or dragging pain is often felt in a case of carcinoma of the breast, and is by some considered to afford help in diagnosis. The popular idea that cancer of the breast is necessarily a painful affection is of course wholly erroneous.

(*b*) **Swelling.**—A general enlargement of the breast occurs normally at puberty, both in the female and, sometimes, in the male sex. This enlargement may be attended with a slight degree of pain. The condition is easily recognised by the age of the patient. The general enlargement of the breasts which occurs in pregnancy is not likely to lead to any error in diagnosis. Occasionally a cancerous tumour occurring during pregnancy may be overlooked, owing to its being buried in the enlarged breast.

A general enlargement of the breast occurs in the rare disease known as hypertrophy of the breast. This occurs very rarely in the male sex. It is most common in young women, and is probably always bilateral, affecting both breasts at the same time.

Cases of supposed hypertrophy of one breast usually prove to be cases of large soft tumours (fibro-adenomata or lipomata) of the breast itself or neighbouring parts. Careful examination in such a case will almost always show that the normal, although displaced, and perhaps flattened, breast can be felt resting upon the tumour, and is more or less separable from it.

A breast may appear to be enlarged when it is not really large, but merely pushed forwards by something behind it. A post-mammary abscess is the most common cause of such enlargement; but any kind of swelling behind the breast may produce the same effect. Distortion of the chest-wall in cases of lateral curvature of the spine, and locally prominent rib cartilages, will thus produce an apparent swelling of a breast.

General enlargement of one breast alone is almost always due to inflammation, and is usually seen in women during the period of lactation. Indeed, any enlargement of a breast, whether general or local, occurring during this period should always primarily suggest inflammation.

Acute inflammation of the breast is usually easily recognised by the ordinary local and general signs of inflammation. Of these, œdema is one of the most important; a patch of œdema, especially if there be a soft spot in the centre of it, commonly indicates suppuration. Acute inflammation may be closely simulated by the brawny form of cancer. Cancer occurring in a breast which is enlarged from pregnancy is apt to grow rapidly, and the general swelling of the gland may easily mask the more characteristic signs of tumour. The adhesion of the swelling to the skin, which is so common a feature of cancer, is simulated by the inflam-

matory hardening and fixity of the skin which occurs in cases of inflammation both acute and chronic. The absence of fever, and the absence of tenderness in the affected axillary glands, both point towards cancer. On the other hand, a chronic abscess deeply seated in a large breast may cause no fever and but little pain; the nipple may be deeply retracted, and there may be considerable hardness and fixity of the skin over the lump.

Although inflammation is much more common during the childbearing period than at any other, it may nevertheless occur even in advanced age. It is precisely in elderly women that a hard and comparatively painless lump of inflammatory nature is likely to be mistaken by a careless observer for the more serious disease.

The presence of distinct nodules in the skin over and around the breast is conclusive of malignancy.

Rapid emaciation does not usually point especially towards malignancy, since absorption from inflammation may easily cause this. Cancer, on the contrary, not uncommonly advances to a comparatively late stage before the general health is appreciably affected. A woman may appear to be in robust health and yet have a hopelessly advanced carcinoma of the breast.

A form of inflammation which sometimes closely simulates carcinoma is the tuberculous. Here the signs of inflammation are often ill marked, owing to the chronic nature of the affection. There may be considerable induration of the breast. If the skin be affected, there may be an indolent ulcer tending slowly to extend. The edges of the tuberculous ulcer are, however, usually undermined, and the discharge is more profuse and purulent. The skin around a carcinomatous ulcer is

always infiltrated and hard. The axillary glands in a case of tubercle, although usually enlarged and not particularly tender, lack the characteristic hardness of malignancy. An exception must be made, however, in the case of old tuberculous glands, which may be of stony hardness owing to fibrosis or even calcification. The past history, the family history, and the presence of tuberculous lesions in other parts of the body, may afford help in the diagnosis of tuberculous disease of the breast.

The greatest difficulty in the diagnosis between inflammation and cancer is to be seen in those rare cases in which a malignant tumour has become inflamed, so that the signs and symptoms of inflammation are superadded to those of carcinoma. The presence of a tolerably definite hard mass in the breast, and the hard enlargement of the axillary glands, will nevertheless usually serve to indicate carcinoma.

A somewhat diffuse form of cancer occurring in patches over a considerable area of breast tissue may be very difficult to distinguish from the chronic fibroid or inflammatory condition often met with in old people. In the absence of such characteristic signs of cancer as local infiltration of neighbouring parts and affection of glands, the best means of distinguishing between the two affections is by the greater hardness of the malignant disease. The presence of small hard round nodules, like large shot, in the breast itself, is not uncommon in the simple fibroid disease, the nodules being small innocent cysts. Sometimes it is impossible to make a certain diagnosis without an exploratory incision.

A single well-defined lump in the breast, which is not inflammatory, is probably either a fibro-adenoma, a

cyst or a carcinoma. Sarcoma is so uncommon, and so difficult to diagnose clinically from the softer forms of carcinoma, that it need not be considered here apart from carcinoma.

Fibro-adenoma is essentially a disease of early adult life, and usually first makes its appearance before the age of thirty, that is, at an age when cancer is uncommon. Its positive characters are roundness, nodularity and slow growth. The older the patient and the older the adenoma, the more likely is the latter to contain much dense fibrous tissue, and to be very hard. It is well not to pay too much attention to a history of the tumour having been noticed for a short time only. Many an innocent tumour of the breast has lain for years quietly buried in a big breast without ever attracting attention. If a large breast becomes small, as at the menopause for instance, such a tumour becomes relatively much more prominent and distinct. Under these circumstances, the patient may then in perfectly good faith give a most fallacious and misleading history of only short duration.

A single cyst is rounded and smooth. It is usually distinctly elastic, and may be so soft as to give rise to a definite sense of fluctuation, especially if large or if situated near the surface.

The presence of one or more small hard shot-like bodies elsewhere in the breast will suggest a cyst, the smaller bodies being similar cysts in an earlier stage. Such multiple cysts are not uncommon in elderly women in whom the breast is undergoing involution.

A cyst of the breast is sometimes surrounded by a ring of indurated breast tissue, which obscures the roundness and elasticity of the cyst itself. In such

cases, the flatness of the whole swelling, together with the softness of its centre, sometimes serves to distinguish it from carcinoma.

The history of a cyst is frequently that of a slowly growing tumour extending over months or years. Not uncommonly the history is a very short one. Indeed, a rounded swelling which has attained a considerable size in the course of two or three weeks, and which is not inflammatory, is probably a cyst.

In such cases the cyst has, doubtless, existed for a long time, but has attracted no attention until a comparatively sudden effusion of fluid into it has drawn attention to its presence. A blood-stained discharge from the nipple shows that the cyst contains intracystic growth, innocent or malignant. Multiple cysts in the breast produce an irregular mass or a number of separate rounded tumours, the nature of which is usually not difficult to diagnose. Cysts sometimes occur in the interior of carcinomatous tumours, but these seldom lead to errors of diagnosis, since the hard carcinomatous growth around the cyst is usually sufficiently characteristic.

A cyst is most likely to be mistaken for a carcinoma when it is small, tense, and deeply seated in the breast.

A carcinoma, on the other hand, is most likely to be taken for a cyst when it is soft and does not as yet show any evidence of local infiltration or of affection of glands.

A carcinoma is diagnosed with certainty before operation only when there is evidence of local infiltration or of glandular implication. Adhesion to the skin, retraction of the nipple, and adhesion to the

pectoral muscle, are the three principal signs of local infiltration. The occurrence of any one or more of these depends largely upon the situation of the tumour, the size of the breast, and the amount of fat surrounding it. A tumour at the periphery of the breast is not so likely to cause retraction of the nipple as one which is near that structure. A tumour situated at the anterior or posterior surface of the breast is more likely to cause early adhesion to skin or muscle respectively, than one which is in the centre of the breast. Much fat surrounding the breast diminishes the liability to adhesion to skin or muscle. In a fat person the dimpling of the skin over a deeply-seated carcinoma is often as characteristic of carcinoma as actual infiltration of the skin would be.

In many cases of early carcinoma there are no signs of local infiltration or of glandular affection. In such cases the diagnosis can seldom be absolutely certain until an incision has been made into the tumour. But a probable diagnosis can often be made. The mere presence of a hard lump in the breast of a woman over thirty years of age should raise a strong suspicion of carcinoma, unless distinctive signs of cyst, adenoma, or chronic inflammation are also present. If there is any doubt about the diagnosis an exploratory incision will usually clear this up. Occasionally it is necessary to remove a portion of tumour and examine it microscopically before the diagnosis can be settled with certainty. But, as a rule, the naked eye appearances as seen on section are quite sufficiently characteristic.

(*c*) **Discharge from the nipple.**—Besides the natural secretion of the breast, there may come from the nipple serous fluid, pus or blood. In certain

inflammatory conditions of the ducts there may be discharge of serous or purulent matter. An abscess opening into a main duct will discharge pus at the nipple.

The discharge of blood from the nipple indicates disease of a duct. It usually indicates either a tumour of the duct, such as a duct papilloma or a duct cancer, or else that a tumour originating outside a duct has penetrated the lumen of the latter. A blood-stained discharge from the nipple usually indicates duct carcinoma. The presence of a rather soft tumour and the absence of affection of the axillary glands generally serve to distinguish duct carcinoma from the more serious forms of malignant disease.

(*d*) **The superficial affections** of the skin over the breast and affections of the nipple present but little difficulty in diagnosis. It is well to remember that a primary syphilitic sore sometimes occurs at the nipple in women who are nursing syphilitic children other than their own.

There is also a form of malignant dermatitis which occurs at the nipple and gradually destroys it (Paget's disease). It is to be diagnosed by the induration of its base, which distinguishes it from simple eczema, and by its slowly progressive course.

Various other affections of the skin may occur in the region of the breast, but are not especially characteristic of this part, and require no special description.

CHAPTER XIII.

DISEASES OF THE ABDOMEN—DIAGNOSIS OF AN ABDOMINAL SWELLING.

History.—In ascertaining the history of an abdominal tumour there are two points to which attention should be especially directed.

1. **Where did the swelling begin?**—Has it always occupied its present position, or did it begin in one place and gradually move to another?

Information on this point, if sufficiently definite, may be of much help in determining to which abdominal viscus the origin of the tumour is to be assigned. Thus in the case of a large cystic tumour supposed to be either ovarian or hydronephrotic, a history of the tumour having been first noticed in one or other iliac region or at any rate in the lower part of the abdomen, will point to an ovarian origin, while a history of commencement in the loin will naturally seem to indicate a renal origin. Similarly a tumour that was first noticed near the left costal margin and gradually extended downwards and to the right is likely to be of splenic origin. Attention to the early history of the situation of a tumour is particularly important in the

case of those organs such as the spleen, which are likely to become greatly displaced from their normal situation.

2. **Have there been symptoms indicating derangement of the functions of the organ to which the tumour is supposed to belong?**

Marked diminution in the amount of urea in the urine may indicate renal disease, the vomiting of blood may point to disease of the stomach, and so forth.

Too much reliance, however, must not be placed upon this alteration of function as evidence of disease of the organ itself. Vomiting is a symptom of many abdominal disorders besides that of tumours of the stomach. Irritability of the bladder occurs in connection with pelvic affections other than those of the bladder itself.

In the diagnosis between enlargements of the kidney and of the gall-bladder, the presence of blood or pus in the urine would naturally point strongly towards kidney. But it must be remembered that two or more diseases may co-exist: a patient with slight pyuria, for example, may also have a distended gall-bladder.

In every case of abdominal tumour it is well to inquire into the functions of all the principal abdominal viscera, and to ask whether there are, or have been, any symptoms referable to the gastric, intestinal, hepatic, or genito-urinary organs.

Physical examination.—During the physical examination of an abdomen, the patient should at first lie upon his back with the shoulders slightly raised and the knees flexed. The patient should be told to

breathe quietly and deeply. It is a good plan to carry on a conversation with him during the examination, so as to distract his attention and prevent him from holding his breath or making the abdominal muscles rigid. Some portion of the history of the case may be obtained in this way while the surgeon is making the physical examination.

Inspection of the abdomen should comprise the following points:

Is the abdomen enlarged? If so, is the enlargement general and uniform, or is it local?

Is the abdominal wall retracted?

Do the abdominal muscles move freely with respiration, or are they kept rigid?

Are the superficial veins enlarged or distended? and, if so, does the blood in them flow in the usual direction?

If there is a visible abdominal swelling of any kind, is it stationary, or does it move up and down with the respiration?

The presence of any disease of the skin, of an ulcer, sinus, or scar, and the condition of the umbilicus, are of course points to which attention should be directed.

The relation of a visible abdominal swelling to the muscles of the anterior abdominal wall is ascertained by putting these muscles into action. This is done by telling the patient to fold his arms across the chest and then to attempt to sit up. The contraction of the muscles, and especially of the recti, will lead to the flattening and partial or total disappearance of a swelling situated behind the muscles. Swellings situated in front of the muscles are not affected at all by

this movement. A swelling in the muscular wall is variously affected according to the exact position it occupies and the amount of muscle covering it.

Palpation.—The hand should be laid flat on the abdomen, and the whole region gently, carefully, and systematically palpated; at first superficially, then deeply.

When palpating the loin, both hands should be used; one placed in front, the other behind.

In palpating the gall-bladder, kidney, spleen, and sometimes other organs, it is often advisable to turn the patient partially over on to his face. By this means the viscera are made to fall towards the anterior abdominal wall; they may thus be more easily felt. Any unusual tenderness, whether superficial or deep, should be noticed.

In palpating for the spleen, liver, or gall-bladder, the fingers should be pressed deeply into the hypochondriac regions, and the patient told to take a deep breath, so as to drive the viscera down upon the examining fingers.

In palpation of the kidney, the surgeon should sit facing the patient, and place one hand on the loin and the other upon the abdomen; an enlarged or moveable kidney can be grasped between the two hands. Except in emaciated subjects, or persons in whom the abdominal wall is unusually lax, the normal kidney cannot be felt.

General anæsthesia, by producing relaxation of the muscular wall, is of great assistance in deep palpation of the abdomen.

Percussion.—Percussion is used chiefly (1) to define the limits of the liver and spleen; (2) to detect

the presence of fluid; (3) to ascertain whether certain apparently solid or liquid tumours contain gas or not.

Over the liver and spleen there are normal areas of dulness; the rest of the front and sides of the abdomen should be resonant. Dulness anywhere means the presence of solid or liquid in contact with the abdominal wall. It should be remembered that even a large collection of fluid may give a resonant note when intestine is mixed up with it. A large air-containing cavity, *i.e.*, dilated stomach or colon, may give a higher resonant note. The "bell sound" may be obtained over such cavities.

Percussion is of most value when the abdomen is tensely distended, and palpation of the viscera is consequently not easily effected. Percussion of the colon in the loin, with the patient in the knee-elbow position, affords a valuable means of distinguishing between a distended gall-bladder and an enlargement of the kidney.

Auscultation is not of much value except for the detection of aneurysmal bruit, of local friction, and for the detection of splashing and other sounds in hollow viscera containing gas and liquid.

General and uniform Enlargement of the Abdomen

is due to one or other of the following conditions:

1. **Obesity**, often associated with atony and laxity of the intestinal walls and accumulation of flatus.

Mere obesity is usually easily diagnosed by the thickness of the subcutaneous layer of fat, by the general appearance of the patient, by the absence of tension in

the abdomen, and by the depth of the umbilicus. The existence of obesity should not, however, deter the surgeon from making a very thorough examination of the whole abdomen, with the view of finding whether the enlargement of the abdomen is not also in part due to some other condition. The existence of obesity naturally adds considerably to the difficulty of the examination.

2. **Gaseous distension of the intestines.**—This may be due merely to atony of the intestinal walls and undue decomposition of the intestinal contents, as in the tumid abdomen of rickets, cretinism, and other conditions associated with chronic gastro-intestinal disturbance. Distension of the abdomen from these causes does not produce any great amount of tension, and this fact serves to distinguish this variety of distension from the far more serious form of distension due to accumulation of gas above a stricture or other form of mechanical obstruction of the intestine.

The distension due to the latter cause is most marked when the obstruction is low down in the large intestine and is chronic in its course. Under these conditions the distension may be enormous and the tension very great.

A third form of gaseous distension, and a very common one, is that which accompanies peritonitis and other forms of inflammatory trouble in the abdomen.

3. **Fluid in the peritoneal cavity.**—(*a*) Liquid. (*b*) Gas.

(*a*) **Liquid (Ascites).**—The shape of an abdomen that is much enlarged from the presence of free liquid is usually very characteristic. The weight of the liquid

causes the abdominal walls to bulge laterally; the anterior surface of the abdomen is more or less flattened out. If the amount of fluid is large, a wave of fluctuation can be made to pass between the two hands placed one on either side of the abdomen; but this is less characteristic of free fluid than of fluid contained in a localised large cavity, such as that of an ovarian cyst. In examining for a wave, the hand of a second person should be pressed vertically upon the front of the abdomen to steady it and prevent transmission of impulse along the abdominal wall.

Alteration in the limits of dulness, according to the position of the patient, is an important and valuable sign of liquid free in the abdominal cavity. The liquid naturally occupies the lower part of the space in which it lies. Consequently free fluid in the abdomen gives dulness in the flanks and hypogastrium, while the upper and central parts of the abdomen, occupied by gas-containing viscera floating upon the liquid, yield a resonant note. When the patient is turned on one side, the opposite flank, now the highest part, becomes resonant.

In the case of a large liquid-containing cyst, such as an ovarian, the intestines are pushed upwards and into the flanks. Consequently these regions are resonant, while the hypogastric and umbilical regions, occupied by the cyst, are dull.

It should be remembered that even when the abdomen contains much liquid the flanks may not be wholly dull if the fixed portions of the colon (ascending and descending) happen to be distended with gas.

The diagnosis of liquid in the abdomen is sometimes confirmed, if necessary, by tapping; but this, as a

diagnostic measure, is not advisable, owing to the risk of wounding intestine and causing serious harm.

The liquid that is found free in the abdominal cavity may be of any of the following varieties:

(i) The ordinary clear, ascitic fluid (much the most common). The ascites may be merely a part of a general anasarca; in this case œdema of the lower limbs, scrotum, or other parts may be present, and attention to the state of the heart, lungs, or kidneys will reveal the cause of the ascites. The ascites may be due to some local (abdominal) cause. Of this the most common is probably cirrhosis of the liver, or some other obstruction to the portal circulation. It is important to bear in mind that obstruction to the venous circulation in any of the abdominal viscera may lead to exudation of serum from the congested blood-vessels, and thus produce ascites. Apart from disease of the heart, lungs, liver, and kidneys, and from ascites due to passive congestion, ascites is most often due to chronic inflammation of the peritoneum (tuberculous or simple), or to malignant disease.

(ii) The ascitic fluid may be blood-stained. Blood-stained ascitic fluid, if not due to injury, generally indicates malignant disease either of the peritoneum itself, or more often of some viscus the disease of which has penetrated the peritoneum. Very rarely blood-stained fluid is found in connection with tuberculous disease. It is also seen occasionally in cases of acute strangulation of any viscus, but especially of the small intestine. In cases of acute strangulation of an abdominal viscus the amount of peritoneal fluid is usually not very great.

(iii) The contents of a ruptured cyst (usually ovarian) may be present in the abdominal cavity in such a

quantity as to simulate ordinary ascites. In these cases, however, the fluid usually consists in part also of inflammatory secretion from the peritoneum. The fluid is characterised by its viscidity.

(iv) In cases of injury to the liver, spleen or other viscera, blood may be found in large quantity in the peritoneal cavity. Urine and even bile may also be present in considerable quantities after rupture of the bladder and gall-bladder respectively.

(v) Cases in which the peritoneal fluid presents a milky appearance (chylous ascites) are, in this country, so rare as to be of very little practical importance, and the diagnosis usually presents no difficulty.

(*b*) **Gas.**—Free gas in the peritoneal cavity practically always means perforation of a gas-containing viscus, and is consequently of very grave import.

The diagnosis is based partly upon the distension and hyper-resonance of the whole abdomen, but mainly upon the absence of normal liver dulness.

Absence of liver dulness is occasionally due to intestines lying in front of the liver, but this is exceedingly rare.

Great diminution, or even absence, of liver dulness may be observed in cases in which, from atrophy or other cause, the liver is exceedingly small.

4. **Tumours springing from one of the abdominal organs** occasionally attain such an enormous size as to practically fill the abdomen and thus to cause an appearance of general and uniform enlargement. By far the commonest of such tumours is the ovarian cyst, but occasionally a tumour of the uterus (fibroid) and kidney (hydronephrosis) will attain similar dimensions.

In all these cases, however, it will generally be found on careful examination that the enlargement is not strictly uniform. Careful attention to the relative positions of dull and resonant areas and to the presence or absence of symptoms referable to individual viscera will generally give the clue to a correct diagnosis.

5. **A combination of any one or more of the above** with any of the local swellings described in the following section, *e.g.*, malignant disease of the ovary with ascites, chronic intestinal obstruction with peritonitis, &c.

In these cases there may be the greatest difficulty in diagnosis, since the distension caused by one condition may entirely mask the physical signs of the other.

The best way to arrive at the truth is to consider carefully, (i) how far the existing signs and symptoms can be explained by one or other of the above conditions; and (ii) what signs and symptoms are present which can *not* be explained by them, and for which, therefore, some other explanation must be sought.

Local Swelling of the Abdomen.

In investigating a local abdominal swelling its situation is the first point that we have to determine.

We may consider separately—

1. Swellings in the anterior abdominal wall.
2. Swellings behind the anterior abdominal wall.

1. **Swellings in the anterior abdominal wall** may be in the skin or subcutaneous tissue, in the muscular and aponeurotic layers, or behind the muscles.

Swellings in the skin or subcutaneous tissue are generally markedly prominent, and their free mobility upon the muscles will usually serve to distinguish them from swellings of deeper origin.

To test the mobility of a swelling upon the abdominal muscles, these latter should be put into action (by telling the patient to attempt to sit up). If the swelling can then be moved freely upon the contracted muscles, it is not connected with them or with their fibrous aponeuroses.

Such swellings do not differ essentially from those of the skin and subcutaneous tissue in other parts of the body, and need not be further discussed here. Swellings originating in skin or subcutaneous tissue may, however, become secondarily adherent (by inflammation or infiltration of new growth) to the muscles, and their movement will then be restricted according to the degree and extent of such fixation.

Local and prominent swellings, such as ventral herniæ, which are obviously mainly superficial to the muscles, may appear to move more or less upon them and yet be attached by a comparatively narrow pedicle to the abdominal muscles, or to the structures behind them. A large ventral or umbilical hernia may behave in this manner.

The small lobulated tumours which are often seen in the epigastric region in elderly people and which have most of the characters of subcutaneous lipomata are likely to be attached in this way to the abdominal wall; they will generally prove to be herniated portions of subperitoneal fat. Occasionally they have a peritoneal covering, and are true ventral herniæ containing omentum.

Swellings in the muscular and aponeurotic layers of the anterior abdominal wall are not common.

Tumours, especially sarcomata, may arise in any part of the abdominal wall, and are generally distinguished from inflammatory swellings by their extreme hardness and definite outline, and by the absence of tenderness.

A form of tumour not very uncommon in women is the dense fibroma that springs from the aponeurosis of the external oblique, generally near Poupart's ligament. Its slow growth and its hardness usually suffice for the diagnosis.

Blood cysts, due to rupture of some of the muscular fibres, are occasionally seen in this region; they occur especially within the sheath of the rectus. The abrupt limitation on the outer side of the edge of the rectus sheath may afford a clue to the diagnosis.

Inflammatory swellings in the same region may closely simulate them, but have usually some deeper origin.

Such are the very common inflammatory swellings of the abdominal wall, which have their origin in diseases of the organs or cellular tissue of the pelvis, iliac fossa or loin.

All inflammatory swellings which do not clearly move upon the abdominal muscles should be suspected to have some connection with the interior of the pelvis or abdomen, unless they have distinctive characters of their own, or can be proved to be not so connected.

Inflammatory swellings at the lower part of the abdomen, in the neighbourhood of Poupart's ligament, are very common, and frequently originate in some

disease of the interior of the pelvis or abdomen. A careful examination of the pelvic viscera may throw much light on their origin. Similarly, inflammatory swellings in the upper part of the abdomen may originate in disease of the liver, gall-bladder, stomach, spleen or thorax, and attention should be directed especially to any symptoms indicative of disease of those parts. Inflammatory swellings at or near the umbilicus are frequently due to extension of inflammation from the peritoneal cavity (as in tuberculous peritonitis, malignant disease of the transverse colon, &c.).

It is by no means uncommon for a carcinoma of the large intestine to show the first definite sign of its presence in the form of a deep-seated inflammatory swelling of the abdominal wall.

In these cases the slow perforation of the lumen of the bowel leads to the adhesion of this to the abdominal wall and the gradual extension of inflammation towards the surface.

Careful questioning in such a case will generally elicit a history of some symptoms more or less definitely referable to the intestine.

Swellings then which come through the abdominal wall from the interior of the peritoneal cavity comprise—

(i) Herniæ (ventral and other).*

(ii) Collections of pus, originating in some intra-abdominal disease and perforating the muscular layers. Except in the case of stout subjects, the diagnosis is seldom difficult.

(iii) New growths springing from the interior of the

* For the diagnosis see chap. xvii.

abdomen and perforating the abdominal wall (uncommon except at the umbilicus).

Swellings springing from the anterior abdominal wall behind the muscles cannot be distinguished by their physical signs alone from swellings originating in an abdominal viscus, and secondarily adherent to the muscles.

In both cases, when the muscles are put into action, the mass becomes less distinct to sight and touch; the mass cannot be moved laterally, or in any way separated from the muscles; it can, however, if of moderate size and not extending as far back as the posterior abdominal wall, be made to move in an antero-posterior direction with the muscles. The hand should be laid flat upon the swelling and then suddenly pressed backwards. The backward displacement of the mass with the muscles, and its subsequent and **immediate** return with them to the original position, indicate attachment to the abdominal wall.

This test is of most use when the swelling is near the centre of the abdomen, that is where the abdominal wall is capable of the greatest amount of movement.

Swellings springing from the back of the anterior abdominal wall are rare. They include a few cases of new growth originating in the posterior fibrous layers.

The most common growth in this situation is, however, a secondary mass of new growth in the parietal peritoneum. The presence of other secondary growths elsewhere, and evidence of the existence of a primary growth, probably somewhere in the abdomen, will generally be sufficient for a correct diagnosis. Intraperitoneal growths secondarily adherent to the anterior

abdominal wall (such as a carcinoma of the transverse colon) present the same physical signs as those which originate in the back of the anterior abdominal wall. The diagnosis has to be made chiefly by the special signs accompanying lesions of the viscus, whether attached to the abdominal wall or not.

2. **Swellings behind the anterior abdominal wall.**

There is usually but little difficulty in determining that an abdominal swelling is situated behind the muscles of the abdominal wall. By putting the abdominal muscles into action, their relation to the swelling is determined by sight or by touch.

Deep-seated tumours present no difficulty as regards this point. The free movement of the abdominal wall in front of them renders their deep situation evident. Many abdominal tumours permit also of a considerable degree of passive movement, or of movement during respiration, and this mobility alone is usually sufficient to prove that they lie behind the abdominal wall.

Given that a tumour is behind the anterior abdominal wall, the next point to determine is whether it is—

(*a*) In or connected with one of the abdominal viscera.

(*b*) In the peritoneal cavity itself.

(*c*) Behind the peritoneum (*i.e.*, in the retroperitoneal tissue, or in the posterior abdominal wall). Each of these must be considered separately.

(*a*) **Swellings connected with one of the abdominal viscera** will be discussed in chapter xiv.

(*b*) **Swellings in the peritoneal cavity itself.***

Solid swellings in this region are so rare as to be of

* It is scarcely necessary to remind the reader that the peritoneum

no practical importance whatever. Occasionally smooth hard masses of fibrous tissue, or even of cartilage, are found free in the peritoneal cavity; occasionally primary new growths springing from the wall of the cavity may project into its interior.

The only really important localised swellings that are found strictly within the peritoneal cavity are encysted collections of **fluid,** either (i) serous fluid (localised ascites); (ii) blood, rare except in the pelvis (pelvic hæmatocele); or, far more common and important, (iii) pus.

(i) Localised collections of serous fluid are sometimes found in the peritoneal cavity as the result of a chronic inflammation of a portion only of the peritoneum; sometimes they are the remains of an ascites that has once been general. Bands of adhesion uniting viscera, chiefly intestines and great omentum, to one another, may divide the peritoneum into spaces in which fluid may collect.

A large space of this kind becoming filled with clear fluid may present itself in the form of a very obvious and sometimes most puzzling swelling, which, according to its situation, may simulate almost any other abdominal tumour. Usually, however, the irregularity of these tumours, and the fact that they have not the shape and do not occupy quite the ordinary position of swellings of a single viscus, will help in the diagnosis. Following, as they usually do, a general chronic peritonitis (often tuberculous in nature), the previous history and the presence of bands or lumps in other parts of the peritoneal cavity may help in the diagnosis.

is a closed sac, which, in the normal condition, contains nothing at all. The abdominal viscera lie outside the peritoneal cavity.

(ii) **Blood** extravasated into the general peritoneal cavity as the result of injury is usually rapidly absorbed. In the case of extensive hæmorrhages into the lesser peritoneal cavity, however, the blood occasionally remains to form a large blood cyst. These cysts will be discussed on p. 142. Retro-uterine hæmatocele also affords an example of an effusion of blood, which is absorbed but slowly.

(iii) **Pus.**—The diagnosis of an abscess within the peritoneal cavity may present great difficulties. If the abscess be near, or in contact with, the anterior abdominal wall, if the latter be not very thick and its muscles not too rigid, and if the amount of pus be considerable, then fluctuation may be evident and diagnosis is facilitated. More often, however, and especially in the case of deeply-seated abscesses, no sense of fluctuation can be obtained. A more or less distinct lump is all that can be felt. There is little or no movement, since it is fixed by surrounding inflammatory adhesions. Tenderness may be a valuable indication. Elevation of temperature and other general signs of suppuration may be present, but it must be remembered that many even large abdominal abscesses are unattended by fever. Temperature depends upon the absorption of inflammatory products (toxins), rather than upon the accumulation of pus. Severe constitutional symptoms may be present before any definite collection of pus has formed; on the other hand, an abscess surrounded by a well-marked barrier of lymph may give rise to no absorption, and consequently no elevation of temperature. An abscess of this kind connected with subacute or chronic appendicitis is not uncommonly attended by a normal or subnormal temperature.

The early history of the case is of great importance in the diagnosis of an intra-peritoneal abscess. Most of these abscesses occur as the result of a perforation of some hollow viscus, most often the appendix vermiformis.

Collections of fluid in the lesser peritoneal cavity are somewhat uncommon; they give rise to large rounded tumours situated in the upper and left part of the abdomen. They comprise blood cysts, the result of some abdominal injury, generally a severe one, and collections of fluid, the result of perforation of an ulcer on the posterior wall of the stomach. The fluid in the latter case consists partly of the acid contents of the stomach with food *débris*, and partly of the products of inflammation, which may be serous, sero-purulent, or purulent. The diagnosis of fluid encysted in the lesser peritoneal cavity is made partly from the shape and situation of the tumour, partly by observing the relation which it bears in the stomach and transverse colon when distended, and partly by the history of the case.

The differential diagnosis between the two depends upon the history of the case, or, after abdominal section, upon the examination of the fluid contained in the cavity.

As regards physical characters, the tumour which most closely resembles a distended lesser peritoneal sac is a large cyst of the pancreas. The diagnosis is frequently impossible until after abdominal section has been performed and the contents of the cyst have been evacuated. The alkaline nature of the fluid in a pancreatic cyst affords the best means of distinguishing it from fluid having a gastric origin.

(*c*) **Swellings situated behind the peritoneum** (in the retroperitoneal cellular tissue and abdominal wall).

Swellings involving the kidney, suprarenal capsule, and pancreas, will be discussed with the other abdominal viscera.

The remaining swellings in this region include:

(i) Inflammatory swellings (abscess).

(ii) Aneurism of the abdominal aorta.

(iii) Enlargements of lumbar lymphatic glands.

(iv) New growths (chiefly sarcoma) springing from the vertebræ, fasciæ, muscles, &c.

(v) Rarely blood cysts, collections of urine, &c.

The diagnosis of swellings in this region is made by their deep situation, by their fixity, by their tendency to displace forward such structures as the kidney, or abdominal aorta behind which they may lie, and (especially in the cases of new growths and inflammatory swellings) by the involvement of lumbar nerves.

Examination of the back may also help in the diagnosis if the swelling happens to be making its way through the posterior abdominal wall or to be causing a bulging of this in the space between the last rib, the lumbar spine, and the crest of the ilium.

By far the most common of all retroperitoneal swellings is an abscess, generally connected with disease of the spine or the kidney, less commonly with the large intestine, appendix, or some other abdominal or pelvic viscus.

The diagnosis of retroperitoneal abscess depends largely upon the diagnosis of the primary cause, together perhaps with elevation of temperature and other

general evidence of suppuration. It must be remembered, however, that many retroperitoneal abscesses are essentially chronic in nature, and are often wholly unattended by elevation of temperature. Such is usually the case, for example, with the ordinary chronic abscess accompanying tuberculous disease of the spine.

CHAPTER XIV.

DISEASES OF THE ABDOMEN (*continued*). ENLARGEMENT OF A SINGLE ORGAN.

VERY many abdominal tumours consist of an enlargement of a single organ, the liver, spleen, kidney, &c.

The enlargement may be uniform, as in the case of a hypertrophied spleen or distended gall-bladder, or lardaceous liver; or it may be local as in the case of a hydatid of the liver or a fibroid of the uterus.

The first step towards diagnosis has been made when it can be shown that an abdominal tumour involves a single organ.

Diagnosis as regards this point is usually simple in proportion as the enlargement is considerable, and affects the whole organ uniformly.

There are three principal means which lead us to assign an abdominal swelling to a particular organ.

I. It may occupy more or less exactly the normal **situation** of the organ, and **bear similar relations to surrounding parts.**

It must be remembered, however, that a swelling originating near an abdominal viscus may displace it and come to occupy its situation; thus a chronic abscess in the loin may, as regards its situation,

resemble very closely a swelling of the kidney, the latter organ being displaced forwards or in some other direction. Care should be taken therefore, before assigning a swelling to a particular organ on account of its situation alone, to make sure that this organ does not exist in some other part to which it has been displaced by the abnormal swelling.

II. It may preserve more or less accurately the characteristic **shape** of the organ. Thus, a movable swelling which presents a smooth convex surface on one aspect and a flat or concave surface on the other, and has a sharp, well-defined border with two or three well-marked notches upon it, can scarcely fail to be a spleen, in whatever part of the abdomen it may be found. In the case of such a tumour being found far away from the normal situation of a spleen, the diagnosis would be confirmed by the absence of the normal splenic dulness.

III. Quite apart from the physical characters of the swelling itself there may exist **special symptoms** which point definitely to disease of a particular organ; such are alterations in the urine, pointing to the kidney or bladder; uterine hæmorrhage, jaundice, diarrhœa or hæmatemesis, suggesting respectively disease of the uterus, liver, intestines, or stomach.

The following are the principal characters of swellings involving the several viscera.

Liver.—Situation in the epigastrium and right hypochondrium. The swelling extends upwards beneath the ribs and is in contact with them. The anterior and upper surface is smooth and convex. The lower border is well-defined, and there is a notch in it for the round ligament. No intestine lies in front of it.

The dulness is continuous with the normal liver dulness. The latter may be extended upwards as well as downwards.

A certain amount of downward displacement, but usually not very much, may be noticed when the patient takes a deep breath.

Gall-bladder.—The gall-bladder when considerably distended appears in the form of a globular smooth swelling, situated just below the tip of the tenth right costal cartilage, or in a line extending downwards from this point and slightly to the left. If the lower edge of the liver can be felt in or near this line the rounded gall-bladder will be felt just below it.

The gall-bladder, except in a few cases in which it is enormously distended, or in which the whole liver is enlarged or displaced downwards, rarely extends below the level of the umbilicus.

A distended gall-bladder often has a good deal of lateral mobility, but cannot be displaced downwards apart from the liver.

A very large gall-bladder can often be felt bimanually, one hand being placed upon its fundus, the other in the loin just below the last rib. It is this palpability from the loin that leads sometimes to confusion between enlarged gall-bladder and swellings of the kidney. Cases are by no means unknown in which incision has been made upon the gall-bladder from the loin, under the impression that it was a kidney with which the surgeon was dealing.

A distended gall-bladder almost always lies in contact with the anterior abdominal wall, and has therefore no intestine in front of it.

Its relation to the colon may be determined if

necessary by inflating the latter, which will be found to lie below a gall-bladder, but in front of a swelling of renal origin.

From tumours springing from the substance of the liver the gall-bladder can often be distinguished by its lateral mobility, and by its projection away from the liver.

Jaundice, or a history of jaundice, may help in the diagnosis of distension of the gall-bladder; but it must be remembered that in most of the cases in which the gall-bladder forms a distinct tumour, the cause of the distension lies in an obstruction of the cystic duct, and there is consequently no associated jaundice.

Spleen.—Situation in the left hypochondrium, and in a line drawn from this downwards and somewhat to the right. The swelling extends upwards beneath the ribs and is in contact with them.

The anterior and outer surface is smooth and convex. The inner and anterior border is well defined, and at its lower part are one or more well-marked notches which are very characteristic. No intestine lies in front of it. The dulness is continuous with the normal splenic dulness in the mid-axillary line opposite the ninth, tenth, and eleventh ribs.

Most of the above characters can be made out only when the spleen is much enlarged, and extends well below the costal margin. In many cases in which the enlargement is not great, the spleen can be felt only by pressing the fingers deeply into the hypochondrium while the patient takes a deep breath. The spleen is then felt as a rounded mass descending upon the fingers.

Stomach.—The outline of a distended stomach with its convex lower border can often be seen and felt if the

abdominal wall is thin and the intestines not much distended. These conditions are often present in cases of stricture of the pylorus. Marked tympanites in the left hypochondrium, and the presence of a bell sound on auscultation, may help in the diagnosis of distension of the stomach. The outline of a distended stomach is made more evident by inflating it* with air through a soft tube passed down the œsophagus. Or inflation may be conveniently effected in another way, by allowing the patient to swallow separately small quantities of water containing thirty to forty grains of bicarbonate of soda and of tartaric acid.

The possible risk of causing perforation of a diseased stomach by over distension should not be forgotten.

The diagnosis in many cases has to be made, however, not so much by direct physical examination of the stomach as by the evidence afforded by dyspeptic symptoms, and by the vomiting of large quantities of fluid, especially fluid of a thin watery nature. The passage of a tube into the stomach, and measuring its capacity by the injection of fluid, is sometimes of service.

Localised tumours of the stomach are most characteristic when they occur, as they so often do, at the pylorus. In other parts of the stomach they are less easily felt, and their signs are not so distinctive. The diagnosis of a tumour of the stomach, apart from the pylorus, is made partly by its situation, partly by its mobility with varying degrees of distension of the organ, but mainly by the examination of the contents of the stomach, and by the general symptoms.

* In the absence of a better instrument, an ordinary bicycle pump will be found serviceable for this purpose.

Pancreas.—Owing to their deep situation at the back of the abdomen, most swellings of the pancreas have but few physical signs of importance. A lump in the situation of the head of the pancreas, having little or no mobility, is generally all that can be made out by physical examination of the swelling itself. The common malignant disease of the head of the pancreas, and the chronic inflammatory induration of the same part seldom attain large dimensions, and present only the above characters. Occasionally cysts of the pancreas, both unilocular and multilocular, attain a large size, and present the characters of fluid-containing tumours situated in the upper left part of the abdomen. They tend to push the stomach forwards and upwards, and the transverse colon forwards, or forwards and downwards. As has already been mentioned, such tumours simulate very closely collections of fluid in the lesser peritoneal cavity (see p. 142).

The diagnosis of most tumours of the pancreas, however, depends less upon the physical characters of the swelling itself than upon the symptoms produced by the involvement of certain neighbouring structures. The most important of these are the common bile-duct, the pancreatic duct in the pancreas itself, and the duodenum surrounding its head.

Any tumour in the head of the pancreas, but especially the common carcinoma, will tend to involve the common bile-duct by pressure or infiltration, or both. Jaundice will thus be produced. Obstruction of the pancreatic duct is much more difficult to detect, but the loss of pancreatic secretion may perhaps be detected by the presence of undigested fat in the motions.

The duodenum, which nearly encircles the head of the

pancreas, is easily compressed by tumours of that organ, especially if they are of considerable size or enlarge rapidly (as in hæmorrhage into a cyst). Under these conditions, symptoms of sub-acute, or even acute, intestinal obstruction are easily induced. Large cysts of the pancreas are likely also to press upon the transverse colon.

Kidney.—Situation in the loin. It can be felt by the two hands, one of which is placed at the back below the last rib, the other on the front of the abdomen. Rarely the kidney lies further forward and nearer the middle line, resting more upon the lumbar spine. In these cases the tumour is felt with difficulty, or not at all from behind, but forms, on the other hand, a swelling that is more easily detected from the front. The very rare cases in which the kidney occupies an altogether abnormal situation, lying upon the brim of the true pelvis, or in front of the last lumbar vertebræ, do not require any further mention.

It should be remembered that the enlargement of one kidney may be associated with congenital absence of its fellow. The association of hydronephrosis on one side, with congenital absence of kidney on the other, is by no means unknown, and is of much practical importance in connection with operations on the former.

The shape of an enlarged kidney depends upon whether the organ is enlarged uniformly, or whether the pelvis is the main seat of enlargement.

The uniformly enlarged kidney preserves its natural shape, being convex on its outer border, concave on the inner. Distinct lobulation can often be felt in kidneys that are much enlarged.

If the pelvis form the main portion of the swelling,

as in many cases of simple hydronephrosis, then a globular swelling is the result. A greatly distended renal pelvis may present, on its outer or anterior surface, the remainder of the kidney perhaps but little altered, and if this can be felt, it is a great help towards the diagnosis.

Dulness in the loin is characteristic of a renal swelling unless the latter occupy an altogether abnormal position.

The relation of the colon, if it can be made out, is of the greatest importance in the diagnosis of a renal swelling.

If the abdominal wall be fairly thin and the tumour sufficiently large, the colon can be felt as a thickened band running more or less vertically over the surface of the latter and generally firmly attached to it by the peritoneum. The presence of gas in this thickened band helps to determine its nature. In some cases it is even desirable to inflate the colon with air. Its relation to the swelling is then rendered obvious, and the renal, or at any rate retroperitoneal, nature of the tumour is placed beyond doubt.

Irregular swellings involving a part only of the kidney may present great difficulties in diagnosis, especially if they involve the upper end of the kidney and are not very movable. Such are some cysts and masses of new growth. From their close proximity to the liver, gall-bladder and suprarenal gland, they may easily be confused with swellings of these organs.

The **suprarenal** gland, from its small size and deep situation, seldom gives rise to enlargement which can be diagnosed by direct physical examination. Some tumours however, both innocent and malignant, form

large rounded or irregular masses, which are situated deeply in the loin and resemble tumours of the upper part of the kidney.

Tuberculous disease of the suprarenal is often diagnosed with ease, not by the physical characters of the swelling, but by the presence of bronzing of the skin, vomiting, attacks of faintness, and the other well-known symptoms of Addison's disease.

Bladder.—There is seldom any difficulty in the diagnosis of a distended bladder.

The situation of this organ, in the middle line immediately behind the pubes and lower part of the abdominal wall, its accessibility to examination by the finger in the vagina or rectum, and by the sound introduced per urethram, generally leaves no doubt as to the nature of the swelling. Distension of the bladder is occasionally simulated by collections of fluid (pus, urine, or blood), and still more rarely by tumours, in the cellular tissue in front of the bladder. Occasionally swellings behind the bladder, such as enlargements of the uterus, the ovary, or even the Fallopian tube may resemble the bladder itself. Cysts in connection with the bladder itself, such as pouches from the bladder and hydatids in the cellular tissue close to it, will sometimes cause difficulties in diagnosis.

Large malignant tumours of the bladder filling up the pelvis and rising out of it sometimes resemble distension of the bladder. The emptying of the bladder with the catheter, if this is possible, and observation of the extent to which a catheter can be passed and its direction, will generally serve to obviate any error. Inability to pass a catheter (*e.g.*, from

stricture) or an erroneous history as to the complete emptying of the bladder by micturition, may occasionally lead to error.

Uterus.—The situation of this organ between the bladder and upper part of the rectum, in the pelvis or rising up out of it, and its accessibility to direct examination by the hand upon the abdomen, the finger in the vagina and the sound in its interior (if it is permissible to make use of this), are in most cases sufficient for a diagnosis as to the uterine nature of the swelling. In the case of the pregnant uterus, the characters of the cervix, the state of the breasts and the other well-known signs of pregnancy, afford material help in the diagnosis. Discharges from the interior of the uterus (blood, pus, &c.) also help in many cases.

Small uterine swellings are likely to be confused with swellings of the ovary, tube, or broad ligament, and with collections of fluid or inflammatory swellings in the immediate neighbourhood of the uterus. Large uterine swellings rising up into the abdomen are likely to be confused, in the absence of history or other evidence of pregnancy, with ovarian cysts and occasionally with tumours of the bladder, intestine, mesentery and retroperitoneal cellular tissue.

The subject is one however which belongs rather to the gynæcologist than to the general surgeon.

Intestines.—Distension of the intestines may of course affect any part of the abdomen, but usually affects all parts nearly equally, filling up the whole abdomen. The shape of a distended colon would in itself be very characteristic were it not for the fact that such distension is almost always accompanied and obscured by the distension of the small intestine above

it. The characteristic shape of the colon cannot therefore usually be felt, and it is difficult to say how much of the distension is due to colon, and how much to small intestine. Careful palpation, percussion, and auscultation will however sometimes enable the situation of the distended colon to be accurately traced. Distension of the small intestine alone, or of a part of it, sometimes permits of diagnosis. A mass of resonant intestine that can be pushed about from side to side in an abdomen that is not greatly distended consists of small intestine. Sometimes numerous coils of intestine are matted together by chronic inflammation into irregularly rounded masses that are freely movable and not difficult to diagnose. They are especially common in young children.

The diagnosis between general abdominal distension due to the intestines and that due to other conditions has already been discussed.

CHAPTER XV.

ABDOMINAL PAIN.

Abdominal pain is often the most prominent symptom of which the patient makes complaint. It seems well, therefore, to devote a few pages to its consideration, and to discuss its value from a diagnostic point of view.

Abdominal pain may be merely a referred pain due to some irritation at the origin of, or in the course of, nerves which eventually reach the abdomen. The pain so often felt in the front of the abdomen in cases of acute caries of the lumbar or lower dorsal spine is a familiar example.

Bearing in mind this point then, that abdominal pain may be due to disease away from the abdomen itself, and that the cause may have to be sought in disease of the spine, we may pass to pain which has its origin in the abdomen.

In the vast majority of cases, abdominal pain originates in disease of the abdomen.

The **situation** of the pain may indicate the situation of the disease, and generally does so. But very often the situation of the pain does not correspond to that of the disease. The pain originating in disease of one part of the abdomen may be felt chiefly or wholly in another.

Thus, a stone in the kidney may cause a pain which is felt mainly or even wholly in the testis; the pain caused by strangulation of a portion of small intestine may be felt at the umbilicus; that of disease of the liver may be referred principally to the shoulder. In most of these cases, however, the pain is not limited to the distant part, but is felt also at the actual seat of disease.

Indeed, it may be laid down as a rough general rule, which is not without value, that diseases of the kidney tend to cause pain referred to the groin, testis, labium, or down the thigh; diseases of the intestine tend to cause pain referred to the umbilicus; while diseases of the liver are apt to produce pain in the back and right shoulder. It is common, too, for patients suffering from painful affections of the stomach to complain of pain in the "chest" or "heart."

It is sometimes said that disease of an organ on one side of the abdomen may cause pain to be referred to the opposite side of the abdomen.

Thus, stone in one kidney has been said to cause pain simulating stone in the other kidney.

It may, however, be reasonably doubted whether such transference of pain from one side of the abdomen to the other ever really occurs.

Cases in which such appears to have been the case are probably instances either of error on the part of the patient or of the surgeon, or cases in which disease existed on both sides of the abdomen.

It is sometimes said with truth that the pain of an acute appendicitis is felt more upon the left side than upon the right. This is, however, not an example of transference of pain, but rather an indication that the peritoneal inflammation caused by the

appendicitis has spread across to the left side. The margin of an area of spreading peritonitis is often more painful than the area in which the inflammation had its origin, and where it has reached a later and probably less painful stage.

Local abdominal pain must be taken to indicate local disease at the same spot only when it is accompanied by local physical signs. Of these the most important is tenderness or pain on pressure. Another valuable indication of local disease within the abdomen is the contraction of the abdominal muscles, the resistance to deep palpation, so common a sign of local inflammatory disease.

The **character** of abdominal pain naturally varies widely. There may be every degree, from slight pain amounting to little more than discomfort, up to the most severe and excruciating agony. The pain may be constant or intermittent.

Pain occurring every evening suggests suppuration.

Almost any disease of the abdomen may cause some pain at one time or another. The mere weight of an otherwise harmless swelling may cause a dragging pain; so may adhesions. A very slight amount of inflammation in any part of the abdomen may lead to more or less pain.

We are concerned here, however, not so much with the slighter forms of pain which are in themselves not usually characteristic, but rather with those severe forms in which the pain is the most prominent feature of the case.

Pain is due either to tension or to inflammation. In a sense we may say that all pain is due to tension, since even the pain of inflammation is due to the tension of inflammatory products acting upon minute nerves.

Severe abdominal pain, however, such as renal colic, may occur independently of inflammation. Although painful inflammation cannot really occur without tension, yet tension may occur without inflammation and may be the cause of most severe pain. Ordinary renal colic is a good instance of the latter. For practical purposes then it is useful to remember that severe abdominal pain is usually due either to acute inflammation or to tension without inflammation. Frequently the two are associated, as in the painful distension of an inflamed organ.

A sudden and severe Attack of Abdominal Pain

generally indicates one or other of three conditions:

1. It may indicate colic, either intestinal, biliary, or renal.

2. It may be due to the rapid onset of acute peritonitis; this, in many cases, is of the form known as perforative peritonitis.

3. It may be caused by acute strangulation of the intestine (or, rarely, of some other abdominal viscus).

Each of these may be accompanied by vomiting and by collapse.

There are, however, many points of difference in the symptoms of the various conditions.

1. **Colic.** (Intestinal, biliary, or renal.)

The term colic, although originally derived from, and referring, to an affection of the colon, has now no such restricted meaning. It may be used for any abdominal pain of a spasmodic or paroxysmal nature.

Colicky pain is due essentially to spasm of involun-

tary muscles, and the tension (generally distension) of the affected part. In intestinal colic it is the contraction of the involuntary circular muscular fibres that causes the pain. The pain may be compared to that of the contraction of the voluntary muscles in tetanus. The part of intestine affected may be distended or not. In biliary colic it is the spasmodic contraction of the muscular fibres of the distended gall-bladder (rarely the gall-duct) that causes the pain. In renal colic it is the distension of the kidney caused by blocking of the ureter that is the cause of pain. It is scarcely necessary to say that the pain of biliary and renal colic is not due to the scraping of a stone along the duct. The stone is fixed when the colic is at its height.

The symptoms of renal colic, too, are not invariably due to a hard substance like a calculus. They may be caused equally well by a soft blood clot or anything else that completely and suddenly blocks the ureter and causes urine to distend the kidney behind the obstruction.

Tenderness may be present with colic, but it is not a marked feature, and may be completely absent. More than this, local pressure frequently relieves the pain of a mere colic, and often serves to distinguish between colic and the pain that is due to acute inflammatory disease. In biliary and renal colic, in which there is a distended, and, perhaps, also a somewhat inflamed gall-bladder, or kidney, local tenderness may be sufficiently marked. In all forms of colic the early history of the case and the presence of symptoms pointing definitely, either in the present or in the past, to disease of the intestine, kidney, or biliary passages may help in the diagnosis.

A normal temperature in cases of mere colic, although by no means sufficient to exclude inflammatory disease, also helps in the diagnosis.

2. **Acute peritonitis.**

Here pain is a very variable symptom, and is no criterion of the severity or seriousness of the disease.

In the earlier stages of the disease it is due to the inflammation of the peritoneum itself; in the later stages, spasm of muscles, distension of intestines, and the tension due to accumulation of inflammatory products, play their part in the production of pain. Sudden acute peritonitis is due to the entrance of septic material into the peritoneal cavity, and to the irritation caused thereby.

This introduction of septic matter is caused almost invariably by the perforation of one of the hollow viscera or by the rupture of an abscess. Septic matter may also pass through the wall of a viscus and set up peritonitis without the production of a "visible perforation." In these cases the onset is generally less sudden and acute. A healthy viscus will not allow the transmission of bacteria through its wall, but if the latter be inflamed, paralysed by over distension, or otherwise diseased, then such transmission may occur. It is in this way that peritonitis may be set up around a strangulated piece of bowel, or in the neighbourhood of an inflamed, although not necessarily perforated, appendix.

The amount of septic matter which is suddenly extravasated into the peritoneal cavity does not bear any definite relation to the amount of pain produced. It does bear a definite relation as a rule to the symptoms of shock, and of the subsequent peritoneal absorption

which takes place. A very small quantity of septic matter extravasated from a perforated stomach or appendix, may cause a most violent pain, especially in young people. On the other hand, the sudden bursting of a large abscess or the sudden perforation of a distended cæcum, although usually painful, may be almost unattended with pain ; the symptoms of shock are those which predominate in such cases. It is in old people especially that peritonitis without pain is most likely to occur, and care should be taken in such cases that the absence of pain should not lead to the erroneous conclusion that peritonitis cannot be present.

The nature of the extravasated fluid is of more importance in the production of pain. The extremely irritating contents of the stomach and small intestine are likely to cause excessive pain. Comparatively unirritating fluids, like healthy bile and healthy urine, may cause but little pain.

It should ever be borne in mind that the seriousness of peritonitis, as regards the life of the patient, depends not upon the intensity of the local inflammation, but upon the absorption of septic matter that takes place. Death from "peritonitis" is not due to the inflammation of the peritoneum, but to the absorption of septic matter that takes place so readily from the peritoneal cavity, itself a vast lymphatic space.

Indeed, peritonitis in itself should rather be regarded as protective and beneficial, in that it tends in many cases to limit and prevent that absorption. The abundant exudation of sticky lymph that exudes from an inflamed peritoneal surface tends to check absorption by interposing a barrier between the septic matter and the general lymphatic and circulatory systems.

The most valuable clinical indication of absorption from the peritoneum is a rapid and increasing pulse rate. Elevation of temperature is, in the early stages at least, much less important. A fall of temperature is generally the first effect of sudden and extensive peritoneal absorption; later on, the temperature may rise above normal and to a great height, as the general blood poisoning becomes more marked. But in some of the worst and most rapid cases the temperature never reaches the normal.

The diagnosis of a perforative peritonitis having been made in any given case, the next point to consider is the **seat of the perforation.**

In endeavouring to answer this, which is often a very difficult question, we may consider, more or less separately, four points.

(*a*) General conditions as to age and sex.—In children and young adults generally, appendicitis is the most frequent cause of perforative peritonitis. It is much less commonly the cause in people who have passed middle life.

In young women perforation of a gastric ulcer is common. The possibility of a perforation having its origin in inflammatory disease of the pelvic organs should not be ignored.

A duodenal ulcer may occur at any age, but is, perhaps, especially common in young men.

Beyond middle life the possibility of perforation of the gall-bladder becomes more probable, as does also that due to malignant disease of stomach, intestine, or other part.

(*b*) Previous history of the case, with special reference to symptoms pointing to disease of any particular

organ.—A young woman with symptoms of dyspepsia and anæmia will naturally suggest gastric ulcer; a young man with the same symptoms is not unlikely to have duodenal ulcer. It is very important, nevertheless, to remember that conclusion must not be too hurriedly formed on these grounds alone. Many an abdomen has been opened for supposed perforated ulcer of the stomach, and appendicitis has subsequently been found. (The converse mistake, too, is one that has often been made.)

Many patients with appendicitis give a history of chronic dyspepsia, and anæmia is often one of their characteristics. A history of chronic constipation, with occasional attacks of diarrhœa and attacks of sick head-ache, will point to appendicitis. Biliousness, hepatic pain, perhaps even jaundice, may point, especially in elderly persons, to perforation of a gall-bladder. Perforation of a gall-bladder is, however, not common.

A history of chronic and severe intestinal obstruction culminating in sudden peritonitis suggests perforation of the bowel. This usually takes place at the cæcum, but may occur at the seat of obstruction. It is obvious that if the patient develops symptoms of perforative peritonitis in the course of, or during convalescence from, typhoid fever, it is probable that a typhoid ulcer is the cause.

(*c*) Exact situation of the pain at the onset of the attack.—Patients suffering from perforation of an organ at the upper part of the abdomen, *e.g.*, the stomach, often refer this pain to the whole abdomen or to the lower part of it. This generally means that the extravasated fluid has gravitated downwards. This

low situation of the pain is likely to cause serious error in diagnosis. Such error may, however, generally be avoided if care is taken to ascertain the situation of the pain at the very beginning of the attack; at this early stage it will probably have been felt at the seat of perforation.

Conversely, perforation of the appendix may cause pain all over the abdomen, or even at the upper part, but the latter is very rare.

The position that the patient has assumed has naturally some influence on the situation of the pain. If the patient keeps the upright position, extravasated material tends to fall by gravity towards the lower part of the abdomen. A patient who keeps strictly to the recumbent position has a better chance of keeping the extravasated material localised to the neighbourhood of the perforation.

With a clear and distinct history of localised pain at the beginning of an attack of perforative peritonitis, it may be concluded, in the absence of other evidence, that pain at the upper part of the abdomen probably means perforation of stomach, duodenum, or gall-bladder; pain beginning at the lower part of the abdomen, either perforation of some pelvic abscess or of the appendix; appendicitis being still more likely if the pain be distinctly in the right iliac fossa.

(*d*) Local physical signs, such as the presence of a definite area of tenderness, of muscular resistance, of dulness, or even of a tumour, may afford material help in the diagnosis. Frequently, however, when the case is first seen, there is so much general distension of the abdomen that physical examination does not throw much light upon the seat of the perforation.

3. Acute strangulation of intestine.

This condition is less common than either of the two preceding. The pain, although often present, is not usually very severe in the early stages. At first it is rather of a dragging nature and is generally referred to the umbilicus. If the strangulation be a hernial ring there may be local pain at that part.

Later, colicky pains set in, due to the contraction of the muscular fibres in the distended portion of intestine above the obstruction.

Later still, the strangulated portion of intestine sets up peritonitis, and the symptoms and signs are gradually merged in those of peritonitis.

The great and characteristic symptom which serves chiefly to distinguish acute obstruction from the other causes of abdominal pain is the violent and frequent vomiting. Vomiting, as has already been mentioned, is a common symptom both of some forms of simple colic and of peritonitis, but in these cases it is almost always much less severe and violent. Some forms of irritant poisoning may simulate intestinal obstruction, but are generally distinguishable by careful attention to the history and by the special signs that they may present. Tenderness is not a marked feature of intestinal strangulation before peritonitis has set in. Nor does the pulse show that tendency to rapid increase which is so characteristic of acute peritonitis.

The same may be said of constipation, which is always complete and absolute in intestinal strangulation, but often less marked in inflammatory conditions of the abdomen, and still less so in cases of mere colic. In both of these conditions flatus may be passed even when there is no evacuation of solid matter.

CHAPTER XVI.

INTESTINAL OBSTRUCTION.

When the surgeon is called to a case of supposed intestinal obstruction he will do well to ask himself first of all whether the case is really one of true mechanical obstruction; whether, if acute, it may not be rather one of those numerous cases of inflammatory disease of the abdomen (appendicitis, peritonitis, enteritis, &c.) which so often and so closely simulate true mechanical obstruction.

The diagnosis is to be made chiefly by careful attention to the early history of the case, and to the nature and urgency of the vomiting. He must endeavour to separate the symptoms of inflammation from those of obstruction, and assign their relative value to each. The difficulty of diagnosing between inflammatory conditions and conditions of mechanical obstruction is naturally increased by the fact that intestinal obstruction sooner or later is complicated by such inflammatory conditions. To the symptoms of obstruction are superadded those of peritonitis. Similarly in some cases which began as simple inflammation without obstruction, such as appendicitis or peritonitis, the symptoms of obstruction become added to those of inflammation. For example, an abscess of the appendix may press upon the ileum so as to cause a mechanical obstruction; or an inflammatory

band of adhesions may produce a similar effect; or the inflamed and distended intestine may become so paralysed as to be incapable of contracting, and thus acts as an obstruction. If the case be a chronic one without urgent symptoms, the question will arise whether there is an actual mechanical obstruction, or whether the case is merely one of obstinate constipation. A gradual narrowing of the intestine, from the presence of a new growth or the contraction of an ulcer, may cause practically no prominent symptoms at all beyond constipation, and diagnosis is consequently difficult. In the absence of more definite evidence of an obstruction, the amount of tension in the abdomen is the best guide.

Given that there is reasonable evidence of true mechanical obstruction, the next points are to determine if possible the nature and seat of the obstruction. In endeavouring to determine these two points, we have to consider—

1. Evidence from the age, sex, and general habits of the patient.
2. Evidence from the previous history of the patient.
3. Evidence from the symptoms actually present at the time.
4. Evidence from physical examination of the patient.

1. Age, sex, and general habits of the patient.

Age alone is sometimes a valuable aid to the diagnosis. Symptoms of acute obstruction in a young infant would, in the absence of any contra indication, point strongly towards intussusception, since no other form of acute obstruction (other than congenital obstructions at and immediately after birth) are at all common at this age.

The diagnosis of intussusception can usually be easily confirmed by careful physical examination. In children who are no longer infants acute obstruction is likely to be due to bands of adhesion caused by previous inflammatory disease of the abdomen. Bands of adhesion due to old appendicitis are common; so are those connected with inflamed and suppurating tuberculous glands in the mesentery. Congenital bands, associated or not with Meckel's diverticulum, are also not to be ignored at this age.

In adult life, and at any point of it, the various forms of hernia, both internal and external, become common, as also obstruction due to twists and kinks of small intestine. Beyond middle life obstruction due to malignant disease becomes frequent; much less common, and occurring almost exclusively in advanced life, is obstruction from gall-stones.

Consideration of the age of the patient, however, does little more than suggest a probable cause for the obstruction. The actual diagnosis depends upon history, symptoms, and physical examination.

Inflammatory conditions of the pelvic organs are of course common in women. These may lead to adhesions which in their turn are fertile sources of intestinal obstruction in this sex.

Habits of life.—But little need be said under this heading. Elderly people of sedentary habits are those in whom obstruction by gall-stones, and the chronic obstruction due to impacted fæces, are most likely to occur.

Long-continued neglect of the bowels may have some share in the production of a volvulus, and certainly contributes to fæcal impaction.

2. **Previous history.**

Careful inquiry should be made about the previous history as regards any injury or disease of the abdomen, or any abdominal symptom that may throw light on the cause of the obstruction. A history of previous peritonitis or other acute inflammatory affection would suggest the presence of bands of adhesion causing strangulation or kinking of the intestine. A history of a severe abdominal injury, or an operation on the interior of the abdomen, may give a similar clue. A history of long-continued diarrhœa may suggest intestinal ulceration leading to stricture; a history of dysentery, or even of residence in a tropical climate, may suggest cicatricial stricture. A history of typhoid fever, however, can scarcely be taken as pointing towards stricture, since it is well known that typhoid ulceration very rarely leads to stricture.

Particular attention should naturally be paid to the manner in which the intestinal functions have been performed, and especially to a history of long-continued constipation. A history of long-continued constipation with occasional attacks of complete obstruction would suggest a volvulus of the sigmoid flexure. Inquiry should also be made as to the previous existence of a hernia.

3. **Symptoms.**

The two prominent symptoms of intestinal obstruction are vomiting and constipation.

With regard to the vomiting, it may be stated that as a general rule it is most urgent and sets in earliest in those cases in which the obstruction is high up. To a certain extent the acuteness of the obstruction also determines the severity of the vomiting. Sudden and complete strangulation of the small intestine causes immediate and violent vomiting.

In a case of gradual closure of the large intestine by a malignant growth, the vomiting may, on the other hand, be delayed for weeks. It may not set in until long after other signs of obstruction, such as constipation and abdominal distension, have become very marked.

As extreme examples may be mentioned the two following cases that came under my own observation :

One was that of a young man with acute strangulation of many feet of small intestine, who was already moribund within a few hours of the first onset of symptoms.

The other was that of a middle-aged man with a carcinomatous stricture of the large intestine, who had suffered for no less than five weeks with absolute constipation, and who, nevertheless, appeared to be in good health, was not vomiting, was able to get about, and who complained of nothing except the constipation and great distension of the abdomen.

Acute obstruction is most common in the small intestine ; chronic obstruction usually has its seat in the large intestine. It should be remembered that a chronic obstruction may suddenly become acute at any time. This will mean, if the obstruction is high up, that a partial obstruction of the intestine has become complete, as by the blocking of a stricture with a lump of intestinal contents. The occurrence of acute symptoms, however, in a case of chronic obstruction, wherever its situation, more often means the supervention of inflammatory symptoms, such as peritonitis, due to rupture of the serous coat of the intestine, or to gangrene or perforation of the intestine. The early occurrence of vomiting in a case of intestinal obstruction is favoured by attempts to take food.

The nature of the vomited matter does not usually afford material help in the diagnosis. In all forms of obstruction the vomited matters tend at the later stages of the affection to become foul and ill-smelling. It is in cases of obstruction of the large intestine that the vomited matters are truly fæculent, and have the foulest smell.

Constipation in every case of complete obstruction is, of course, complete and absolute. Nothing passes through the obstructed portion of gut; nothing, therefore, can be passed from the rectum except what may happen to have been in the rectum or bowel below the obstruction. Even this is not usually expelled. One, or even more, evacuations of such contents may take place, or these contents may, to a certain extent, be washed away by enemata. Even flatus is not usually expelled in a case of genuine obstruction. Constipation, being a symptom which requires time before it can show itself, is not of much value in the diagnosis of the early stages of acute obstruction.

In cases in which the obstruction has lasted more than a day or two, constipation becomes a symptom of importance.

Discharges of blood and mucus from the anus do not militate against the presence of an obstruction. On the contrary, they often afford material evidence of the nature of the obstruction. Blood and mucus afford an early and characteristic symptom of intussusception, since the strangulated and congested portion of intestine lies within the lumen of the bowel below the obstruction, and hence discharges from it are free to find their way out through the anus.

Intussusception in a young child is most likely to be

confused with simple diarrhœa and vomiting due to some error in diet, or to intestinal tuberculous ulceration. In the latter case, the resemblance to intussusception may be very close, since the ulceration may lead to the presence of blood and slime in the motions, while enlargement of mesenteric glands connected with the intestinal ulceration may form a swelling that can easily be mistaken for an intussuscepted portion of bowel.

In cases of stricture, malignant or otherwise, accompanied by much ulceration, discharge of blood and mucus may occur, but is rarely a prominent symptom.

In the majority of cases of malignant stricture of the large intestine, at least above the rectum, bleeding is not a marked feature.

In the very rare cases of large polypi obstructing the bowel, there may be a discharge of blood and mucus, and the same may be said of the equally rare cases of foreign bodies causing obstruction. The foreign body causes inflammation of the wall of the intestine, and this inflammation gives rise to the discharge of mucus, and perhaps of blood.

The subject of pain in connection with intestinal obstruction has already been discussed on page 166.

4. **Physical examination.**

Direct examination of the seat of obstruction may be attempted from the rectum or from the front of the abdomen. The importance of a careful and thorough examination in both of these ways is obvious.

Examination by the rectum will reveal at once the presence of any stricture, malignant or otherwise, at the anus or in the lower part of the rectum; that is, the part within reach of the examining finger. Stricture

higher up may also be detected sometimes by a careful examination and especially by bimanual examination. A malignant stricture of the sigmoid flexure or upper part of the rectum sometimes falls down into the pelvis in such a way that it can be felt through the wall of the rectum.

An intussusception not uncommonly descends so low that it can be felt in the rectum, or it may even protrude from the anus. The slight depression that can be felt near the apex of the intussusception, and which is the entrance to the lumen of the bowel above, forms the most reliable means of distinguishing between an intussusception and a polypus. In the case of an intussusception that has descended as low as the rectum the other symptoms are usually so characteristic that there is but little probability that any difficulty in the diagnosis will occur. Pelvic tumours and bands of adhesion, &c., in the pelvis may be felt and may throw light on the cause of obstruction. Careful bimanual examination may lead to the detection of an obturator or femoral hernia, especially if the abdomen be not very tense, so that the external examining hand can be pressed well down towards the pelvis. The importance of a vaginal examination in women need only be mentioned.

In the great majority of cases of acute obstruction, rectal examination reveals nothing more than a general bulging downwards of the abdominal viscera, and no light is thrown on the cause of the obstruction.

Attempts to examine the upper part of the rectum by the introduction of the whole hand are of no real value. Examination by a bougie may help in the detection of a stricture that is just beyond the reach of

the finger, but is of no use for the detection of obstruction much above this.

Attempts are sometimes made to ascertain the situation of an obstruction by determining the amount of fluid that can be injected into the lower bowel. Such attempts seldom lead to conclusions of any value. The rectum itself may hold a considerable quantity of water when the obstruction is as low down as the sigmoid flexure. On the other hand it may happen when the obstruction is as high as the small intestine that the amount of intra-abdominal tension is nevertheless so great that not more than a few ounces can be injected into the large intestine. The forcible injection of fluid into the large intestine in cases of intestinal obstruction is not without risk of causing serious harm by producing perforation, &c.

Abdominal palpation in most cases of intestinal obstruction reveals little except general distension of the abdomen.

The possibility of the obstruction being due to external hernia should never be forgotten, and careful examination of the various hernial apertures should always be made.

If an external hernia be present, it must not be too readily concluded that this is necessarily the cause of the obstruction. If the local signs of a strangulated hernia (tension and want of impulse) are not present it may be suspected that the cause of the obstruction is to be sought elsewhere. A patient with a reducible or even an irreducible hernia may be the subject of a strangulated hernia in some other and less obvious situation, or even of an obstruction due to some wholly different cause.

It is in the early stages of obstruction, and in cases in which the abdominal wall is not much distended and not very tense, that abdominal palpation is likely to afford most help.

In young children especially, in whom the abdominal wall is usually soft and yielding and whose lower ribs are not rigid, much may be ascertained by abdominal palpation.

The true pelvis of an infant is so shallow that a finger introduced through the rectum can be passed right through the pelvis. Most of the abdomen can be thus explored bimanually with tolerable ease, and an intussusception in most cases can easily be detected.

In all cases of intestinal obstruction the intestine above the seat of obstruction tends to become distended, while that portion below it remains empty and flaccid. The amount of abdominal distension then, taking into consideration the duration of symptoms, affords some guide as to the situation of the obstruction.

Thus an obstruction high up in the small intestine will cause but little if any distension; an obstruction in the large intestine quickly causes great distension.

An important but rare exception to this is seen in cases of strangulated diaphragmatic hernia. In these cases there is frequently no distension of the abdomen; the abdomen may even be quite hollow. The reasons for this are that so much of the intestine has passed up through the diaphragm into the thorax, and that the obstruction is often very high up, involving the stomach itself. A careful examination of the thorax helps in the diagnosis. Such cases are often, and easily, mistaken for pneumothorax.

The amount of urine passed by the patient is sometimes said to afford help in the diagnosis of the seat of obstruction, being small when the obstruction is high up.

In all cases of acute obstruction, however, the amount of urine is diminished, wherever the seat of obstruction. The amount of urine passed depends on the quantity of fluid absorbed, and this again depends not so much on the quantity of intestine available for absorption as on the amount of fluid ingested and the frequency of the vomiting. A patient who vomits immediately after drinking any fluid, or who is constantly vomiting independently of drinking, will naturally pass but little urine.

Finally it must be admitted that in very many cases the exact diagnosis of the nature of an intestinal obstruction cannot be made with certainty until the abdomen has been opened and explored. That there is a mechanical obstruction which demands exploratory laparatomy is often the utmost that can be said before operation. And fortunate is the surgeon who, after opening an abdomen in the belief that he would find a mechanical obstruction, has never had to confess that he was wrong, and that the symptoms were due, after all, to some form of inflammatory condition.

CHAPTER XVII.

HERNIA.

By the term hernia is meant a protrusion of some portion of the abdominal viscera through an opening in the abdominal wall. There is therefore necessarily **direct continuity between the external swelling and the viscera within the abdomen.**

The first point to be established therefore in the examination of a case of supposed hernia is whether this continuity can be ascertained to exist. In most cases this is easy enough. If the tumour be lifted up or drawn gently away from the opening in the abdominal wall, and the fingers passed beneath it, the neck of the hernia can be felt extending as a more or less thick band or cord passing into the abdomen.

Swellings having their origin outside the abdomen and unconnected with the latter have no such neck, and can be felt to be separate from the abdomen.

In a case of a scrotal swelling, for example such as a hydrocele, the fingers can be made to meet above the tumour between it and the abdominal wall, and it can be definitely ascertained that nothing abnormal exists between tumour and abdomen.

There are some cases, however, in which the existence of this neck cannot be clearly ascertained. A hernial

swelling may be so large and so closely applied to the hernial opening as to make it impossible to feel whether a neck exists or not. This is especially likely to be the case with the more or less globular umbilical and femoral herniæ, which lie more directly over their apertures of exit than do inguinal herniæ.

In the case of the umbilical hernia it is very seldom that any other swelling is large enough to simulate hernia in this way without having decided characters of its own which render diagnosis easy.

But with femoral hernia the case is different. Many swellings in the femoral region can easily simulate hernia. A mass of enlarged glands, a lipoma, or other tumour, may in this respect very closely resemble a hernia.

There are two classes of external swelling nevertheless which do exhibit continuity with the interior of the abdomen and which are not herniæ. One is that in which a collection of fluid or even a solid swelling extends from the abdomen through its wall and forms an external swelling. A psoas abscess extending into the upper part of the thigh, a collection of pus tracking down through the inguinal canal into the scrotum or through some other spot in the abdominal wall, or peritoneal fluid extending along an unobliterated funicular process of peritoneum into the tunica vaginalis (congenital hydrocele), are examples of this. Occasionally a mass of new growth within the abdomen or pelvis may pass along some weak spot in the abdominal wall, such as the inguinal or femoral canal, and thus come to simulate hernia.

The other class is that of cases in which a swelling originating outside the abdomen extends upwards into

it. Thus, a testis enlarged from inflammation, tubercle, or malignant disease, may cause great thickening of the cord, and the latter may thus come to resemble, to a certain extent, a hernial neck.

Sometimes the spermatic cord with its covering muscle (cremaster) may be much thickened by hypertrophy, from having to support a heavy swelling such as a hydrocele, that has long been attached to it.

A small swelling, such as an enlarged gland in the femoral canal or a lipoma or encysted hydrocele within the inguinal canal, may be so deeply seated that it is impossible to draw it down sufficiently to ascertain whether it has a neck or not, and difficulties in diagnosis may arise.

We may pass now to the second characteristic sign of a hernia, namely the **impulse on coughing**. The more or less fluid contents of a hernia (gas or liquid) communicating freely with the interior of the abdomen allow an impulse to be transmitted readily from the interior of the abdomen to the external swelling. Thus an impulse produced within the abdomen by coughing passes to the hernial swelling, where it can easily be felt. It is sometimes a little difficult to distinguish the true hernial impulse from the false impulse caused by the movement of the abdominal wall in immediate contact with the hernia. But a little care and drawing the tumour as much as possible away from the muscle will generally serve to obviate error.

There are, however, other swellings besides herniæ which give an impulse on coughing. Any collection of fluid which is partly within and partly without the abdomen, may give an impulse. A psoas abscess affords a good example. So does the column of blood

within a large vein. Thus it happens sometimes that a dilated saphenous vein and a varicocele are mistaken for hernia on account of the impulse which they receive on coughing. The impulse received by a dilated vein is, however, much softer and less distinct than that of a hernia, and is best described by the word "thrill" rather than impulse. No one who has once felt this thrill of a varicocele or varicose saphenous vein is likely to confound it seriously with the impulse of a hernia.

Impulse on coughing is so commonly found in a hernia and so characteristic of it that it is important to bear well in mind that there are two kinds of hernia which do not present an impulse. One is the hernia whose contents are solid (*e.g.*, the omental hernia), and the other is the hernia which is strangulated. In neither of these two cases can the impulse b transmitted from the abdomen to the hernia.

In the case of a hernia containing intestine, **resonance on percussion** affords a valuable sign. This sign may, however, be presented by rare cases of abscess containing gas, and in cases of distension of the scrotum with air (*e.g.*, from fractured ribs), but neither of these is likely to be confounded in practice with hernia.

Reducibility, if present, is, of course, a very valuable sign of hernia, and is especially valuable if the reducibility is effected with the characteristic and well-known gurgle, showing that the contents consist of both gas and liquid. Gurgling often affords evidence of hernia, even when the swelling is not reducible. Fluid swellings, such as psoas abscess and varicocele, are also reducible, but in these cases the swelling subsides impalpably and without this gurgle. If there be

any doubt between hernia and a venous swelling, such as varicocele or a varicose saphenous vein, the doubt can be cleared up by reducing the swelling, then putting a finger over the inguinal or femoral ring, and then getting the patient to stand up. The venous swelling which fills from below soon returns in spite of the pressure of the finger. But a hernia is thereby prevented from descending.

Some help in the diagnosis of hernia can sometimes be obtained from careful palpation of the abdomen, and especially of the iliac fossa. If the abdominal wall be sufficiently lax, a resisting mass may be felt on the inner aspect of the hernial ring. This is the band of mesentery or omentum passing towards the hernial aperture. In the case of femoral, and still more of obturator, hernia a careful bimanual examination with one finger in the vagina or rectum may be of the utmost value, revealing the presence of this intra-abdominal band.

History.—Most herniæ begin as small protrusions at the site of the hernial aperture in the abdominal wall, and then gradually and slowly enlarge. They tend usually to pass away from the situation of the neck, as when, for example, an inguinal hernia descends into the scrotum, or a femoral hernia passes upwards and outwards across the groin.

Sometimes a hernia begins by suddenly appearing as a large swelling. These are usually cases in which the hernial contents have descended into an already existing sac, such as an unobliterated funicular process of peritoneum (congenital hernia).

A history of the gradual descent towards the scrotum will often help in the diagnosis between hernia and

such swellings as hydrocele, which begin below and in their growth extend upwards.

Diagnosis of the different anatomical Varieties of Hernia.

The diagnosis between inguinal and femoral hernia sometimes presents a difficulty.

The diagnosis is made partly by the early history, which may indicate the exact spot at which the hernia first made its appearance; partly by the shape of the swelling. A femoral hernia is usually rounded or semi-globose, or, if oval, has its long axis parallel to Poupart's ligament; an inguinal hernia is usually pyriform, or, if oval, has its long axis more or less in the line of the spermatic cord or round ligament. If the hernia is small the situation of it above or below the inner end of Poupart's ligament may suffice to show whether we are dealing with an inguinal or a femoral hernia. Larger herniæ come to overlap the ligament. If the hernia be lifted up or drawn down it will, however, generally be easy to feel the ligament and the pubic spine below and outside, or above and inside the inguinal and femoral hernia respectively.

The somewhat rare interstitial inguinal herniæ, which are usually rounded, are easily distinguished from femoral herniæ by being situated wholly above Poupart's ligament.

An obturator hernia resembles a femoral hernia in situation, but the swelling is much more deeply seated, and therefore much less distinct. Pain along the inner side of the thigh in the course of the obturator nerve may also afford help in the diagnosis.

The variety of inguinal hernia, known as congenital hernia, has to be distinguished from acquired hernia.

In the former the sac is formed by some portion of the processus vaginalis of the peritoneum, which, as the result of congenital malformation, has not undergone its normal closure during fœtal or early infantile life.

In its most marked form, in which the hernia descends into the tunica vaginalis itself, the diagnosis is easily made by observing that the testis is almost completely surrounded by or buried in the hernia. In an acquired hernia the testis can usually be felt without difficulty at the lower and back part of the hernia.

The funicular variety, in which the hernia descends into the funicular portion only of this peritoneal process, the tunica vaginalis itself being shut off, can often be diagnosed by its shape. It is narrow in proportion to its length, being confined in the tubular funicular process. A hernia which, on its first appearance, descends suddenly into the scrotum, is probably a congenital hernia.

Most congenital herniæ begin in early life, but it must be remembered that they may make their first appearance at any age. It is the abnormal condition of the sac, and not the hernia, which is present at birth, *i.e.*, congenital in the strict sense of the word.

Diagnosis of the Nature of the Hernial Contents.

Most herniæ contain intestine or omentum or both. Some also contain more or less peritoneal fluid. Rarely do herniæ contain other abdominal viscera, such as the ovary, bladder, appendix vermiformis, &c.

Herniæ that contain intestine generally have gas in them, and are consequently resonant on percussion. Gurgling, indicating the presence of gas and liquid, also denotes that intestine is present.

Omentum in a hernia can often be recognised by its firmness and nodularity. Especially is this likely to be the case when the omentum has lain long in the sac and has become thickened, fibrous, hard and lumpy. Umbilical herniæ almost always contain some omentum, because of the close proximity of the latter to the umbilical ring.

Fluid in a hernial sac is commonly met with in cases of strangulation, but is sometimes found apart from this condition.

An old hernial sac may become filled with fluid if the neck of the sac has become closed, *e.g.*, by a plug of omentum. Such a spurious "hydrocele of a hernial sac," as it is called, may resemble very closely an ordinary irreducible hernia as regards its anatomical position and shape.

But the presence of fluid within it is usually easily recognised by ordinary physical signs; and unless the wall of the sac be extremely thick, or the quantity of fluid very small, translucency is easily detected.

Hernia of the appendix can scarcely be diagnosed until the sac has been opened by operation.

Hernia of the ovary may be diagnosed in children without much difficulty; a small oval lump with a narrow cord extending upwards from it is likely to be an ovary. In adults a hernia of the omentum is likely to simulate hernia of the ovary. A clear history of increased pain during menstruation may help in the diagnosis of hernia of the ovary.

Hernia of the bladder may sometimes be suspected from the hardness of the swelling due to the greater thickness of the muscular wall of the bladder. If the diagnosis be suspected, examination with a metallic sound or catheter may show that the bladder is drawn towards the hernial opening.

Diagnosis of the Condition of the Hernial Contents.

A hernia may be in any one of the following conditions: Reducibility—Simple irreducibility—Inflammation—Obstruction—Strangulation. The diagnosis of the first two presents no difficulty, and need not be discussed.

The diagnosis of the third depends on the local signs of inflammation—tenderness, heat, redness, œdema, &c. Signs of local inflammation are of course common with strangulation, and they must not be taken as indicating mere inflammation unless the more serious and important signs of strangulation are absent.

Obstruction is diagnosed by constipation, together usually with some increase in the size of the hernia and irreducibility. Both inflamed and obstructed herniæ are apt to pass at very short notice into a condition of strangulation.

Strangulation of a hernia containing intestine is characterised chiefly by two general symptoms, vomiting and constipation, of which the former is by far the more important, and three local signs—irreducibility, absence of impulse, and tension.

The general symptoms are those of intestinal obstruction, already discussed (p. 167).

The absence of impulse is due to the free communication between the contents of the hernia and those of the abdomen having been cut off. The tension is due to the swelling of the contents from congestion and to exudation of fluid into the sac.

In the later stages of strangulation the symptoms of peritonitis and septic absorption may be added to those above mentioned.

Local pain and tenderness are generally present with strangulation. They are due rather to the accompanying inflammation than to the strangulation itself. They may be completely absent, especially in old people.

Strangulation of omentum may present symptoms similar to those of strangulation of the intestine, but they are usually very much less marked. Vomiting may be entirely absent.

Gangrene and ulceration are late complications, and may be diagnosed, or at least suspected, partly by the duration and severity of the symptoms of strangulation, partly by the general symptoms of septic poisoning, and partly by the local signs. Of the latter, absence of tension, crackling, and redness of the skin are perhaps of the most importance. It is important, however, to remember that any or all of these symptoms and signs may be absent, even when gangrene has undoubtedly occurred.

CHAPTER XVIII.

DIAGNOSIS OF GALL-STONES.

THE surgery of the biliary passages has, in the last few years, made very rapid strides. The diagnosis of gall-stones has, therefore, become a matter of great importance, not only to the physician and to the general practitioner, by whom such cases are usually first seen, but to the operating surgeon as well.

Gall-stones may lie quietly in the gall-bladder or even in the bile-ducts for months or years and cause no symptoms at all. Under these conditions, diagnosis of their presence is impossible, except in the very rare cases in which they can actually be felt grating against one another in the gall-bladder, or in those cases in which from time to time a gall-stone quietly makes its way into the intestine, and is subsequently discovered in the motions.

But even in these cases it is rare to find that there have been no symptoms at all.

The symptoms of gall-stones in the vast majority of cases are those of one or other of two conditions.

1. Obstruction of some portion of the biliary passages.

2. Inflammation of some portion of the biliary passages and of the surrounding structures.

In most cases these two conditions are associated, but it is well to consider them separately, since the symptoms to which each gives rise are very different.

It is well also to remember that in most cases the diagnosis of gall-stones is the diagnosis of one or other or both of these conditions. There are other rarer conditions which cause obstruction or inflammation of the biliary passages, and these, when they do occur, are extremely apt to be mistaken for the effects of gall-stones.

1. Obstruction of the biliary passages.

An obstruction to any part of the biliary passages follows the usual pathological law with regard to obstruction of any hollow viscus or tube. The part behind the obstruction becomes distended with secretion, then undergoes dilatation and hypertrophy.

A gall-stone impacted in the **cystic duct** causes distension of the gall-bladder. The gall-bladder gradually enlarges, and at the same time usually becomes thickened; its walls become hypertrophied in the more or less vain attempt to overcome the obstruction.

If this distension of the gall-bladder be unaccompanied by any inflammation, it will usually be painless or nearly so. A sense of discomfort or a dragging pain in the right hypochondrium due to the weight of the enlarged and distended gall-bladder may be the only symptom of which the patient is aware. Chronic and considerable distension of the gall-bladder is in these cases the only tangible evidence of gall-stones, and in the absence of any evidence pointing to any other kind of obstruction, is to be considered as pre-

sumptive evidence of the existence of one or more gall-stones.

A gall-stone impacted in the **common bile-duct,** that is below the point of junction of the cystic and hepatic ducts, causes dilatation, not only of the cystic duct and gall-bladder, but also of all the hepatic ducts. The whole of the hepatic secretion is therefore pent up behind the obstruction. The hepatic duct and all its branches within the liver become distended. The elastic and distensile liver itself becomes dilated. Two important signs, therefore, appear which are not present with obstruction of the cystic duct alone. These are **enlargement of the liver** and **jaundice.**

Obstruction of the cystic duct in itself, as has already been mentioned, affords presumptive evidence of the presence of gall-stones, since these are by far the most common cause of an obstruction in this situation.

Obstruction of the common duct, on the other hand, does not in itself afford presumptive evidence of gall-stones. Gall-stones are not the commonest cause of obstruction of the common duct. Cancer of the head of the pancreas or the common bile-duct itself, catarrh of the biliary passages, and chronic pancreatitis, are the common causes of obstruction in this situation.

Gall-stones in this situation are to be diagnosed only after these other causes have been carefully considered and excluded, and only if other evidence of gall-stones can be obtained from the history of the case. A steadily progressive painless jaundice, together with enlargement of the liver, if due to obstruction of the common duct (for it may depend upon disease of the liver itself), is generally caused by carcinoma.

And carcinoma, at least in its early stages, does not

usually cause any other signs than those above-mentioned. The patient with carcinoma is almost invariably of middle age or beyond; but so, as a rule, is the patient with gall-stones, so that, unless the patient is young, we do not get much help from consideration of the age.

The early history of the case may, however, afford great help, and point strongly to gall-stones. Thus gall-stones may have, on previous occasions, been passed per anum. The previous existence of gall-stones affords, however, no proof of the absence of carcinoma, since gall-stones and carcinoma frequently co-exist.

A history of similar attacks which have passed off, and especially a history of similar attacks having passed off quite suddenly, points towards gall-stones and away from carcinoma. Attacks of biliary colic point to gall-stones. So does a long history extending over several years.

Marked emaciation is common with, and points strongly towards, carcinoma; but it must not be forgotten that very considerable emaciation may occur with, and be due to, the jaundice itself, quite apart from its causation.

Elevation of temperature, marked tenderness, and other signs of inflammation, point towards gall-stones rather than to carcinoma.

2. **Inflammation of the biliary passages.**

Gall-stones lying in any part of the biliary passages do not in themselves cause pain by any mere mechanical irritation of the parts. The gall-bladder and -ducts, like other abdominal viscera, are not sensitive to mechanical irritation. Pain due to gall-stones is caused either by distension of the parts behind the obstructing stone, or

to inflammation of the biliary passages and of surrounding parts.

But gall-stones may, by their irritation, cause ulceration of the gall-bladder or its ducts, and this in its turn may lead to various inflammatory conditions of surrounding parts.

An ulcerated gall-bladder may perforate and set up a peritonitis, local or general, according to the intensity of the inflammation and the amount of extravasated material.

Perforation is recognised by the ordinary symptoms common to perforative peritonitis anywhere. The situation of the pain in its early stages in the region of the gall-bladder, and perhaps a previous history pointing to gall-stones, will indicate the nature of the perforation.

More common, however, than the sudden perforation is the gradual perforation of an ulcer, which leads to the formation of adhesions limiting or preventing extravasation with the general peritoneal cavity. Suppuration may thus be set up in the neighbourhood of the biliary passages. This may extend to the portal vein, or to the cellular tissue behind the peritoneum, or to the liver itself. When occurring in any of these situations it is extremely likely to lead to septic absorption, accompanied by the usual symptoms, high temperature and rigors, together with local tenderness and pain, and often more or less jaundice. The condition is a most serious and dangerous one.

Suppuration is not infrequently set up within the gall-bladder, and is generally associated with gall-stones. The diagnosis is a matter of much importance, owing to the danger of perforation, and the consequent

necessity of a prompt operation for the evacuation of the pus.

Acute local pain and tenderness, together with the symptoms of more or less absorption, point to suppuration in the gall-bladder, and if the latter can be felt to be distended the diagnosis is tolerably clear.

Suppuration may, however, occur much more quietly within the gall-bladder, and no very definite signs of its presence may have been detected, until a sudden perforation, or the death of the patient, reveal the true state of affairs.

A catarrhal inflammation of the gall-bladder is an extremely common complication of gall-stones. It cannot be too strongly insisted upon that it is catarrhal inflammation of the gall-bladder that, in the great majority of cases of biliary colic, is the immediate cause of the pain.

A distended gall-bladder, due to a stone impacted in the duct, does not cause severe pain, because, under ordinary conditions, the tension within the gall-bladder is not great. But let the tension in such a case be increased by a catarrhal inflammation of the mucous membrane, and the comparatively slight amount of extra secretion into the gall-bladder is then sufficient to cause most severe pain. This pain may last hours or days until the inflammation has subsided, or some of the fluid contents have escaped along the duct.

The catarrhal inflammation of the distended and more or less diseased gall-bladder, and the associated spasm caused thereby, is the cause of the violent attacks of pain that are so often associated with gall-stones in the cystic duct.

Gall-stone colic is not due to the scraping of a stone

along the duct. In most cases the stone is much too large to pass through the duct. Examination of museum specimens shows plainly the impossibility of gall-stones moving along the duct unless they are of small dimensions. Large gall-stones that pass into the small intestine do so by ulcerating directly through the wall of the gall-bladder or -duct.

A gall-stone impacted in the intestine may be diagnosed with considerable certainty by the sudden onset, in an elderly person, of symptoms of acute intestinal obstruction without abdominal distension. If the patient be fat, or if she give a history of previous symptoms pointing to gall-bladder trouble, the diagnosis is confirmed. Mr. Harold Barnard has pointed out that the period of vomiting may be divided into three stages: a first stage of violent vomiting when the stone first enters the duodenum; a second stage of remission when the stone passes down the intestine and away from the neighbourhood of the stomach; a third stage of renewed vomiting caused by the impaction of the stone, generally low down in the small intestine. The same observer points out that in the first stage the pain is referred to the epigastrium, while in the second and third stages it is felt at the umbilicus. This shifting of the pain may be of much help in the diagnosis.

CHAPTER XIX.

DISEASES OF THE RECTUM AND ANUS.

In the investigation of a case of disease of these parts the surgeon should, after asking the usual questions common to all surgical cases (see chap. ii.), direct his attention especially to the following four points:

1. The presence or absence of pain, its nature, degree, situation, duration, and whether it is aggravated by the act of defæcation.
2. The mode in which the rectum performs its normal functions — whether there is constipation or diarrhœa, whether there is a constant or frequent desire to empty the rectum.
3. Whether there is any abnormal discharge from the rectum, and especially of blood, mucus, or pus.
4. Whether during defæcation, or at any other time, there is any protrusion of the wall of the bowel or other structure.

It is well also to inquire into the functions of the neighbouring pelvic organs, bladder and uterus, and to direct attention to the state of the general health, and of the principal viscera of the body, notably the liver and heart.

Much can be learnt about the nature of the case from

judicious questioning with regard to the symptoms that are present.

Each of the above four groups of symptoms may be discussed separately.

1. **Pain.**—As a general rule it may be stated that diseases involving the anus and lower part of the rectum, which are supplied with nerves of common sensation, are more likely to cause pain than those which involve the middle and upper parts which are not so supplied. It is especially cracks, ulcers, and other breaches of surface involving the mucous membrane at the anus itself that give rise to the most severe pain. A history of severe pain started by the act of defæcation, and persisting for a considerable time afterwards, is in itself almost sufficient for the diagnosis of an anal fissure or ulcer. It must be remembered, however, that the anal fissure which gives rise to this symptom is not necessarily the sole disease from which the patient is suffering. It is quite common for a fissure to exist by the side of a pile. In fact, any crack about the mucous membrane of an inflamed part at the anus may give rise to this symptom.

Acute inflammatory affections outside the rectum, such as ischiorectal abscess, may give rise to a good deal of pain, which is generally more constant and less severe than the pain of an ulcer or fissure of the anus. Mere ulceration of the rectum above the anus, whether simple or malignant, is not painful unless it happens to be acutely inflamed, or is accompanied by inflammation which has spread to the surrounding tissues outside the rectum. Much pain in connection with a carcinomatous stricture of the rectum, for example, generally indicates the presence of inflammation of the cellular tissue out-

side the rectum. Sometimes it indicates extension of growth to neighbouring large nerves, such as the sciatic.

Suppuration around the rectum is not usually painful provided that there is a free exit for the pus. An ordinary fistula is not particularly painful unless there is retention of pus.

A very sharp pricking pain, much aggravated by defæcation, sometimes indicates the presence of a foreign body such as a fishbone, splinter of wood, or some similar substance.

2. **Rectal functions.** — Both constipation and diarrhœa may be due to some general disease, or to some local affection of the intestine altogether above the rectum.

Constipation due to disease of the rectum may be caused by some actual obstruction to the lumen of the bowel, such as stricture, or the pressure of a tumour from the outside ; or it may be due merely to atony of the wall of the rectum from habitual over-distension with fæces ; or it may be due to the fact that defæcation is painful, and that the patient consequently defers the act as long as possible. The constipation frequently seen in connection with fissure of the anus is a common example of the latter.

Diarrhœa, if due to local disease of the rectum, generally indicates some ulceration of the wall of the bowel. A mere inflammation of the mucous membrane may produce the same effect. It is not uncommon to find diarrhœa associated with stricture.

A frequent desire to empty the rectum is often present when there is ulceration, or tumour, or other source of irritation in it. Indeed, a feeling that there

is something there, a consciousness of the presence of a rectum, is a common accompaniment of most diseases of this organ, and especially of inflammatory affections.

The shape of the motions is a matter of very little importance. It is often said that narrow tape-like or pipe-like motions are a valuable indication of stricture. It is true that a stricture at or close to the anus will produce motions of this character, but a stricture in this situation can be diagnosed with far more certainty by direct examination. But motions of the same character may be passed when there is no stricture at all, but only a spasmodic condition of the sphincter. In the case of a stricture high up in the rectum, out of reach of the finger, the motions are by no means necessarily altered in shape.

Conclusions drawn from the shape and size of the motions are practically valueless.

3. **Abnormal discharges.**—The passage of **blood** is one of the commonest signs of rectal disease.

The blood may come from some part of the intestinal tract above the rectum, *e.g.*, from the colon, small intestine, or stomach. In this case the character of the blood is generally more or less altered by the intestinal juices. The higher the source of hæmorrhage the darker and more tarry in appearance is the blood. The existence of other signs and symptoms of disease elsewhere will generally suffice in these cases to show that the blood is not derived from the rectum itself.

Painless hæmorrhage from the rectum in the case of a child usually indicates a simple polypus. If the polypus is well above the region of the anus, and is not prolapsed, there are often no other symptoms at all. Hence the importance of making a thorough local

examination in the case of a child presenting this symptom.

Painless hæmorrhage without other symptoms in an adult generally indicates internal hæmorrhoids. Any kind of tumour or ulceration may also cause painless hæmorrhage if it is situated above the sphincter, but the presence of extensive ulceration usually causes the passage of slimy mucus as well as blood.

Mucus.—Inflammation and congestion of the rectal mucous membrane or of any tumour springing from it is apt to cause a discharge of mucus. A hæmorrhoid, for example, gripped by the sphincter ani, exudes a considerable quantity of mucus.

Pus in quantity indicates either extensive ulceration of the rectum or more often the existence of a sinus transmitting the contents of an abscess situated outside the rectum. Abscesses connected with disease of some neighbouring bone or joint, or of one of the pelvic or abdominal viscera, or of the cellular tissue near the rectum, may discharge their contents into the rectum.

4. **Protrusion** at the anus **in a child** generally means prolapse; if the protrusion be small and rounded it is likely to be a polypus.

An intussusception at a late stage may also protrude, but is easily recognised by the severity of the accompanying symptoms and by the passage of a probe between it and the anus. A prolapse, being an inversion of the lower part of the rectum, does not permit of a probe being passed up by the side of it: the skin and mucous membrane are seen to be directly continuous with each other.

Pedunculated innocent tumours occasionally appear

outside the anus in the case of adults as well as in children.

Protrusion at the anus **in an adult** generally indicates hæmorrhoids, usually easily recognised by their colour and by their attachment to the neighbourhood of the anus. The protrusion of a complete ring of mucous membrane (including perhaps muscular and serous layers as well) indicates prolapse. Hæmorrhoids never form a protrusion of more than half an inch to one inch. A prolapse may measure several inches in length.

In elderly subjects hæmorrhoids and a certain amount of prolapse often co-exist.

Malignant tumours rarely become prolapsed, but if small may be found at the apex of a prolapsed portion of bowel.

Pedunculated tumours such as simple polypus often present at the anus, and if small may present some resemblance to a pile. The brighter colour and the absence of any attachment to the anus are usually sufficient for the diagnosis.

Physical examination.—The importance of making a thorough visual and digital examination in every case of disease of the rectum or anus cannot be insisted upon too strongly. No diagnosis should be made, still less should any treatment be undertaken, until such an examination has been made. The practitioner should be on his guard against accepting too readily any diagnosis, such as "piles," that the patient himself may have made, or that has been made by any one else. Only too often does a case of so-called "piles" turn out, on examination, to be one of condylomata, fissure, polypus, or even cancer. Nor

should it be forgotten that a comparatively simple affection, such as piles or fistula, may not be the only disease that is present, nor even the principal one. The piles, fistula, or fissure may be only an accompaniment of some much more serious affection, such as stricture or cancer. Only too often does one see cases in which piles have been diagnosed, and even treated, while a co-existing carcinoma has been completely overlooked owing to careless or insufficient examination.

The local examination should be preceded by a careful examination of the abdomen, to detect the presence of any tumour, enlarged liver, or other cause or accompaniment of the rectal disease. An examination of the neighbouring genital and urinary organs (vagina, urethra, bladder) may also be necessary before a complete diagnosis can be made.

For a proper examination of the anal region, a good light is essential, and the patient should lie on his side with the knees drawn up and with the buttocks facing the light.

Superficial inflammatory or other affections not peculiar to the anal region, such as eczema, sebaceous cysts, warts, and ulcers of various kinds, require no special mention. Condylomata are usually easily recognised as flat-topped, moist, slight raised granulomata situated near the anus rather than actually at the orifice itself, and often lying on the opposed surfaces of the nates.

The external orifice of a fistula may present as an obvious opening discharging pus. More often, however, it is concealed partially or wholly by a little button of granulation tissue, which may have very nearly the colour of the surrounding skin, and which resembles a

little pimple or smooth wart. Upon pushing aside this little elevation the orifice of the fistula may be detected with a probe.

An abscess may be recognised by the ordinary signs of such. It may not be possible, however, to say whether an abscess is in the subcutaneous tissue, that is comparatively superficial, or whether it extends deeply into the ischiorectal region by the side of the rectum, until an internal digital examination has been made.

Careful palpation should be made over the whole of the region round the anus to detect the presence of indurated areas which may indicate the presence of a deep-seated abscess, or of the burrowing track of a fistula (with or without external opening).

The swellings which appear at the anus itself have already been described (p. 199). If piles are detected, it should be noticed whether they are inflamed, ulcerated, gangrenous or thrombosed. The latter condition is recognised by the hardness of the pile. External piles are known by the little folds or tags of skin covering them.

If internal piles are present but not prolapsed, they may sometimes be made to protrude by telling the patient to strain gently downwards.

Often their presence cannot be detected without an internal examination, and it is often not easy to detect them, even with a finger in the rectum, because, when collapsed and empty, they do not present the same rounded sensation to the finger as they do when prolapsed and full of blood.

If the symptoms indicate fissure, the anus itself should be carefully examined after separating the margins of that orifice. It is at the posterior part of the anus that a fissure is most commonly found. If

piles are also present, a fissure is often found underlying and partly concealed by one of them.

A malignant growth at the anus or extending into the subcutaneous tissues is generally easily recognised by its extreme hardness. If any doubt exist, a small portion may be snipped off and examined with the microscope.

In the examination of the interior of the rectum the finger alone is usually sufficient. A probe, bougie or speculum may also be useful in certain cases. Care should be taken to introduce the finger gently and slowly, and it should be well lubricated, so that it slips in easily. In some cases of very painful affections of the anus such as fissure, it may be well to defer the digital examination until the patient is under the influence of an anæsthetic. Normally the interior of the rectum should have a smooth, velvety feel. Any departure from this velvety sensation indicates disease, generally ulceration.

The investigator should, of course, be thoroughly familiar with what he ought to be able to feel when examining a normal rectum. A beginner, for example, sometimes mistakes the normal cervix uteri for a tumour. The internal opening of a fistula may present as a small opening or a little prominence or a little rough patch on the otherwise smooth mucous membrane. Perhaps the best guide to the existence of a fistula is the indurated track that can be felt beneath the mucous membrane. Such an induration, however, does not necessarily show that any internal opening is present. If there is an external opening a probe may be passed into it and, guided by the finger in the rectum, it may then be passed on through the internal opening into the rectum itself. Beginners often over-

look the existence of the internal opening of a fistula, because they begin their examination too high up in the rectum. Most fistulæ have their internal openings close to the anus, between the external and internal sphincter muscles.

In some cases the internal opening of a fistula may be more easily detected by injecting some fluid such as ink or milk through the external opening, and seeing, with the help of a speculum, the escape of the fluid through the internal opening.

A stricture of the rectum is easily detected if within reach of the finger. If not quite within reach, it may sometimes be brought down a little by bimanual examination, the hand on the hypogastrium pressing the pelvic contents downwards till the stricture is brought into contact with the tip of the examining finger. Straining on the part of the patient may also succeed in bringing the stricture within reach of the finger. Examining the patient while he is standing up may also produce a similar result.

Cancer in its early stage may present itself as a small hard sessile mass with a well-defined outline. When ulcerated, it is the hard edge of the ulcer, showing the presence of actual new growth, that is of most value in the diagnosis. It must be admitted that occasionally simple, syphilitic or tuberculous ulcers are surrounded by much hard inflammatory tissue, which may closely resemble the infiltration of new growth.

The presence of hard glands in the pre-sacral tissue may afford valuable aid in the diagnosis of malignancy.

Stricture of the rectum may be of the so-called annular variety, involving but a short length of the rectum, or may be tubular, involving a considerable

length. The upper edge of a carcinomatous growth, or of a stricture of any kind through which the finger cannot be passed, may sometimes be defined in the case of women by examining per vaginam.

In any case of malignant disease an attempt should be made not merely to determine its malignant nature, but also to ascertain its exact extent, its degree of fixity, and the extent to which it has involved the surrounding parts and the lymphatic glands.

Congenital malformations of the rectum fall naturally into three groups:

1. Imperforate anus proper, in which there is either no trace of an anus, or the latter is represented by a mere dimple. In these cases it is important to notice whether there is any bulging of the anal region when the child cries. If there is, it may be presumed that the lumen of the rectum is not far away.

2. Imperforate rectum, in which the occlusion is above the anus, the latter being well formed. The occlusion may be of any degree, from an incomplete partition like a diaphragm across the rectum, up to the condition in which a considerable length of rectum is wholly absent. Cases of imperforate rectum are not so easily recognised as those of imperforate anus, since the diagnosis is not made until a finger has been inserted through the anus.

3. The third group of cases is that in which, together with a malformation of the rectum, there is an abnormal fistulous communication with the genital organs, most commonly the vagina. In such cases, if the fistulous opening be large, the malformation may not attract attention until the child has passed well beyond the period of infancy.

CHAPTER XX.

DISEASES OF THE URINARY ORGANS.

In the investigation of a case of supposed disease of the urinary organs we shall do well to direct our attention, as regards both history and physical examination, to the following four points:

I. Signs and symptoms connected with diminution of the normal excreting power of the urinary organs (kidneys).

II. Alterations in the manner in which the urine is voided from the body.

III. Alterations in the constituents and character of the urine.

IV. Physical examination of the various urinary organs (kidney, ureter, bladder, prostate, urethra).

I. Signs and Symptoms connected with Diminution of the Normal Excreting Power of the Urinary Organs (Kidneys).

The subject of chronic renal disease often presents a pale sallow appearance; there is a tendency to œdema, especially of the eyelids and ankles. He is apt to be languid and disinclined to exert himself actively. The

arteries generally may be hard and show high tension, or they may be distinctly atheromatous. Hypertrophy of the left ventricle, often associated with chronic renal disease, may point in the same direction. So may retinitis. In the later stages of actual uræmia drowsiness, twitchings and other well known symptoms may occur.

Uræmia.—It is convenient, however, to divide the clinical symptoms of what is commonly called uræmia into three groups, which depend upon different conditions of renal inadequacy. A normal person possesses much more renal tissue than is actually required for the purpose of excreting his waste products. This quantity may be gradually or even suddenly reduced by disease or injury, and yet the patient is able to live. But if the total amount of secreting renal tissue is reduced below a certain minimum, which has been estimated at half one normal kidney, then the condition becomes incompatible with life, and the patient dies of uræmia.

The three clinical types are—

1. That in which the patient's kidneys are both more or less suddenly thrown out of work as the result of acute inflammation. These patients show anasarca, and drowsiness deepening into coma; they have twitchings or convulsions, vomit, and pass small quantities of urine, which contains blood, and is loaded with albumen and casts.

2. A second type is that in which, although there may be plenty of renal tissue, for some reason or other the urine cannot be excreted. It is reabsorbed into the circulation, and the patient dies poisoned by his own urinary secretion. Such a patient presents for several days few or no symptoms of disease except anuria; then rather suddenly he becomes profoundly weak, and

has muscular tremor, panting respiration, anorexia, insomnia, and often pin-point pupils. The temperature steadily falls below normal. The patient dies of sheer exhaustion without convulsions or coma.

This condition is seen in cases of calculi completely blocking both ureters, and in those unfortunate surgical cases in which a solitary kidney has been removed, or both ureters have been accidentally tied in the course of an operation. Prompt removal of the calculus or other obstruction relieves the symptoms.

3. The third type is that to which the name of "renal bankruptcy" has very appropriately been applied. It is best seen in cases of gradual destruction of both kidneys, generally by backward pressure from an obstruction in the urethra, such as an enlarged prostate. The valency of the renal tissue is gradually reduced without the production of marked symptoms, until the point is approached at which life can no longer be supported. Then wasting and anæmia, morning vomiting, great thirst, creamy tongue, and panting respiration set in; the urine is plentiful in amount, but of low specific gravity (under 1010), with very little urea, and usually only a trace of albumen and a few casts. A practical point of importance is that the passage of a catheter in such a patient will frequently precipitate the catastrophe, and the patient will die within a week, no treatment being of any avail.

Sepsis plays a very important part in the production of uræmia. A patient whose renal tissue has gradually been reduced by disease (*e.g.*, atrophy from backward pressure), nearly to the point of bankruptcy, may still be able to get about and do his ordinary work, and may appear to be in fairly good general health. The urinary

organs are still aseptic. But let a septic element be introduced (as by the passage of a catheter in a case of chronic enlargement of the prostate), and acute symptoms at once set in. The residue of renal tissue, hitherto just sufficient to carry on its work of excretion, is now unable to do so when hampered by the extra strain of septic inflammation. It breaks down altogether, and uræmia manifests itself.

II. Alterations in the Manner of voiding Urine from the Body.

1. **Frequency of micturition** may be due to increase in the total quantity of urine secreted, as in diabetes and some cases of chronic albuminuria as above mentioned.

More often, however, frequency of micturition means some irritation about the bladder, prostate or urethra, producing a desire to micturate. The irritation of cystitis, of calculus in the bladder, of enlargement of the prostate or of stricture of the urethra, afford familiar examples. Although micturition is frequently performed, the amount of urine passed each time is small.

Marked frequency of micturition by day and when the patient is moving about suggests a calculus in the bladder. The movement of the stone causes increased irritation of the neck of the bladder.

Increased frequency at night, when the patient is warm in bed and the pelvic viscera are apt to be congested, is especially common in cases of enlarged prostate.

2. **Painful micturition** (dysuria).—Painful micturition usually means some inflammatory trouble in the urethra, prostate, or bladder.

An inflamed urethra or an ulcerated spot in connection with a stricture may cause a sharp cutting pain along the urethra during the act of micturition.

Inflammation or ulceration about the neck of the bladder (vesical orifice of the urethra) usually causes a pain that is referred to the end of the penis, often to a point just behind the under surface of the glans. Such is the well-known pain caused by a calculus when it is driven against the tender and perhaps ulcerated vesical orifice of the urethra. Tuberculous or other ulceration in this situation may produce exactly the same kind of pain. So it happens that calculus of the bladder is easily simulated by tubercle.

The pain of cystitis is more diffused, being felt about the pelvic region generally, in the hypogastrium and perinæum and down the thighs. It is especially marked just at the commencement of micturition, owing to the extra tension present at this moment in the tender and inflamed bladder wall.

The greatest amount of dysuria may be expected in a case in which there is acute inflammation about the neck of the bladder, plus an obstruction (*e.g.*, inflamed or ulcerated prostate, simple or malignant).

3. **Alterations in the character of the stream of urine.**—Given a normal outlet for the urine by the urethra and a normal propulsive power in the bladder wall, the urine is propelled forcibly in a good stream.

Any obstruction to the outflow or any failure in vesical expulsive power causes the stream to be lacking in projection.

Atony of the bladder from over distension is an example of the former, stricture of the urethra or

enlargement of the prostate, afford good examples of the latter. The urine, instead of being projected forwards in a good stream, tends to fall directly downwards from the urethral orifice, or may merely dribble away.

The character of the stream in other respects is of little importance. A small stream with good projection is seen only in cases of stricture at or close to the meatus urinarius. A twisted or forked stream may be caused by a stricture in the same situation, but is not seen when the stricture is further back in the urethra.

III. **Alterations in the Character and Constituents of the Urine.**

This is such a large subject that it can only be dealt with briefly. For full details some of the larger well-known text-books must be consulted.

The total **quantity** of urine that is passed often affords valuable indications of disease.

To obtain reliable information on this point, all the urine passed during each period of twenty-four hours must be collected and measured regularly. The quantity is influenced partly by the amount of fluid imbibed by the patient, partly by the presence of diseases such as diabetes or nephritis, partly by nervous influence such as hysteria; partly also by diuretic medicines. A large quantity of urine is passed by patients with diabetes; in this case the urine will have an abnormally high specific gravity.

A large quantity of urine with a low specific gravity generally indicates either chronic nephritis, multiple cystic disease of the kidneys, or hysteria; a temporary

increase in the amount of urine may be caused by emotional conditions such as fright or nervousness.

The **specific gravity** of the urine is of great importance as indicating the amount of solid constituents dissolved in the urine. It must be considered in relation to the total quantity. A high specific gravity may mean nothing more than a concentrated but otherwise normal urine. A high specific gravity (over 1025) should always lead the observer to examine for sugar. A persistently low specific gravity (under 1015) should generally raise the suspicion of chronic nephritis with atrophy of the secreting tissue of the kidneys. Roughly, the specific gravity of the urine is an indication of the amount of excreting tissue in the kidneys.

The amount of **urea** present in the urine passed during a period of twenty-four hours is, however, the best guide to the condition of the kidneys as regards their excreting power. **Mucus** in small quantity is normal, but a large quantity of mucus indicates inflammation of the mucous membrane of the bladder (cystitis).

The **colour** of the urine depends largely upon its concentration. Dilute urine is naturally pale. The colour is also influenced greatly by the presence in it of such abnormal substances as bile, blood, pus, and various drugs, such as carbolic acid.

Urinary deposits. — Urine which on cooling deposits a brick-red or salmon-coloured sediment, which clears away on heating, contains **urates**. A deposit which comes down on boiling, and then disappears on the addition of a drop or two of acetic acid, usually indicates **phosphates**.

Crystals in the urine may be visible to the naked eye in the form of small reddish grains like cayenne

pepper (uric acid); more often they are visible only with the microscope. The three commonest forms are uric acid, oxalate of lime, and triple phosphate, each having a characteristic shape. The two former may point to a calculus in the kidney, the latter generally indicates cystitis, and is due to the splitting up of urea under the influence of micro-organisms.

The most important abnormal constituents of urine are **blood**, **pus**, **albumen**, **bacteria** and **sugar**. The two former, although readily recognisable with the naked eye, when present in sufficient quantity, are best detected by means of the microscope. This is far superior to any of the chemical tests commonly employed.

The clinical importance of blood and pus in the urine is so great that the following chapter will be devoted to their consideration. Albumen and sugar are readily recognisable by well-known tests which need not be given in detail here. The first is recognised by the precipitate formed on boiling, which does not clear up on the addition of a drop of acid; or by its behaviour with cold nitric acid or with picric acid. Sugar is usually detected by its power of reducing copper oxide from a solution of the sulphate.

Hydatid cysts, or hooklets, the ova of Bilharzia, shreds of vesical or renal epithelium, bits of villous growth, and other extraneous matter seen with the naked eye or with the microscope, may afford valuable clues to the nature of the disease from which the patient is suffering.

Bacteria may obtain entrance to the urine from within from the blood stream, as in tuberculous disease of the kidney. Far more commonly, however, they are introduced into the urine directly from without, most often through the medium of instruments. In the

former case the urine remains acid, in the latter the urine decomposes and quickly becomes alkaline.

I am indebted to Mr. Harold L. Barnard for the following scheme relating to the bacteriology of the urine.

URINE.	ACID.	ALKALINE.
Micro-organisms.	Bacillus coli communis. B. typhosus. B. tuberculosis.	Staphylococcus. Streptococcus. Micrococcus ureæ. Bacilli of various kinds.
Origin.	Usually from the circulation through the kidney—absorbed from alimentary canal (in constipation and inflammatory conditions).	From the urethra as the result of retention. Instrumentation.
Effects.	Do not decompose urea.	Decompose urea. Calcium and magnesium phosphates are thrown down as triple phosphates. (Sodium and potassium phosphates not thrown down.)
Appearance of urine.	Cloudiness due to bacteria and epithelial cells. Little or no smell. Decomposes slowly. Settles quickly.	Heavy deposit of pus, phosphates and mucus. Foul smell. Decomposes rapidly. Settles slowly.
Calculi.	Eroded and broken up.	Added to by phosphates.
Symptoms.	Burning during and at the end of micturition. Frequency of micturition. Enuresis in children. Periodical attacks.	Those of ordinary acute cystitis.
Treatment.	1. Calomel. 2. Diluents. Salol. Urotropine (typhoid only).	1. Remove obstruction. 2. Urotropine and acid sodium phosphate very effective. 3. Irrigate or drain.

IV. **Physical Examination of the Urinary Organs** (kidney, ureter, bladder, prostate, urethra).

Kidney.—The physical examination and the character of an enlarged kidney have already been discussed in chap. xiv. (p. 151). The diagnosis of the nature of the enlargement is generally made from the presence of other signs and symptoms.

Very great enlargement usually means either malignant disease or hydronephrosis.

Pyonephrosis does not often attain to a size larger than that of a cocoanut, but a much larger swelling may be formed when a pyonephrosis has leaked and set up a perinephric abscess (abscess outside the kidney).

In these cases the characteristic shape of the kidney is usually wholly obscured. Suppurative conditions of the kidney are apt to cause fixity of the organ to surrounding parts, if the suppuration or inflammation have spread beyond the limits of the kidney capsule.

Thus a simple hydronephrosis of moderate size may sometimes be diagnosed by its smoothness and mobility from a tuberculous kidney. X-rays may be of much value in the detection of stones of moderate and large size.

Exploratory operation from the loin or from the front is often necessary before the exact nature of a renal swelling can be determined.

In exploring a kidney for stone, careful palpation should be made, especially at its pelvis and along the ureter.

If it be deemed desirable to open the kidney to search for a stone, this may be done with least hæmorrhage by splitting the kidney vertically along its outer or convex

border. The interior of the pelvis and the ureter can then be thoroughly explored by finger or sound.

A stone impacted in the lower part of the ureter may be detected by a probe passed down to it from the renal pelvis.

Ureter.—The examination of the ureter may be made in several ways. The vesical orifice can be seen with cystoscope or endoscope. The intra-abdominal portion of the ureter can occasionally be felt through the abdominal wall if the patient is thin and the ureter much thickened, as in chronic tuberculous disease.

The ureter can easily be exposed and examined by sight and touch by a long incision carried from the loin round to the groin, above the crest of the ilium. The abdominal muscles and transversalis fascia are divided, and the peritoneum and viscera drawn inwards and forwards. The upper part of the pelvic portion of the ureter can be exposed by a similar operation, or by an abdominal section, the peritoneum being incised directly over the ureter.

The lower part of the ureter can, in the female subject, be palpated directly from the vagina at its upper and anterior part. Thickening of the ureter from chronic inflammation or the presence of a calculus may be detected in this way.

The interior of the ureter may be examined by sounding or by catheterisation. The proceedings require some little skill and practice, and are much more easy to perform in women than in men. The utmost care must be taken not to introduce septic matter into the ureter during the introduction of the instruments. In women the passage of instruments into the ureter is most conveniently effected with the patient in the genu-

pectoral position, a Kelly's endoscope being introduced into the air-containing bladder, and a forehead mirror being worn by the operator.

Sounding of the ureter is employed for the detection (and occasionally for the dilatation) of a stricture, or for the detection of a calculus in the ureter or pelvis of the kidney. For the latter purpose it is convenient to use a bougie coated with wax, upon which the rough stone will leave an impression.

Catheterisation of the ureters is employed not for the detection of disease of the ureter itself, but for drawing off urine from the kidney, and so for investigating the condition of that organ.

It is of especial importance as affording a means of comparing the secretion of the two kidneys. The amount of urine that can be drawn off by catheterising the ureter gives some idea of the degree of dilatation of the ureter or pelvis of the kidney in a case of obstruction in the ureter.

Bladder.—The bladder may be examined both from without (per hypogastrium, per rectum, or per vaginam) and from within.

Bimanual examination is often useful in the detection of calculi (especially in children), and in the detection of carcinomatous growths of considerable size, especially when situated at the base of the bladder.

From within, the bladder may be examined by sight by means of the endoscope or cystoscope or by exploratory cystotomy (suprapubic); by palpation with the sound; or, after exploratory cystotomy (suprapubic or perineal), with the finger.

Valuable information may also be obtained by means of the catheter, not only as regards the nature of the

fluid contained within it, but also as regards its quantity —*i.e.*, the capacity of the bladder.

Prostate.—Physical examination of the prostate is made chiefly by means of a finger in the rectum ; it is also made from within from the urethral aspect by means of the sound, bougie, catheter, or cystoscope. Occasionally the examination is made from within the bladder through a cystotomy wound by sight or touch.

Examination per rectum.—Simple inflammation of the prostate shows enlargement and tenderness. A soft spot may reveal the presence of a localised abscess. In some cases a considerable area of softness obscuring the normal outline of the prostate may indicate an abscess of considerable size burrowing outside that organ between it and the rectum.

Tuberculous inflammation is shown by enlargement, and often by hardness and irregularity ; sometimes by areas of softening when the tuberculous deposits have broken down. The examination of the vesiculæ seminales is of much importance in the diagnosis of tubercle, since they are usually large and hard in this disease on one or both sides. Calculi, if sufficiently near the surface, may be detected by their extreme hardness. They are often multiple, and it is sometimes possible to elicit a most characteristic grating sensation, caused by the calculi rubbing one against another.

Malignant disease (especially carcinoma, the commonest form) can generally be recognised with ease by the extreme hardness, the nodularity of the growth, and often by its fixity. Often the growth can be felt to infiltrate the neighbouring parts of the bladder and vesiculæ seminales.

The urethral aspect of the prostate is examined by means of sound, bougie, or catheter, which indicate an obstruction at this part of the urethra. True stricture of the urethra, although very common in the membranous urethra, and at any point anterior to this, practically does not occur in the prostatic urethra. An obstruction to the prostatic urethra consequently means either a prostate enlarged from inflammation, simple hypertrophy or growth (adenoma or malignant disease); or it may be due to the lodgment of a foreign body such as a stone within the prostatic urethra. The use of a metallic instrument will readily indicate the presence of a calculus.

The manner in which a sound or catheter passes through the prostate may afford some indication of the nature of the disease.

Thus deflection of the point of the instrument to one or other side means either that the whole prostate has been pushed aside as by a growth outside it, or more often it indicates irregular enlargement, as in the common senile adenomatous enlargement of the organ.

An instrument which can be made to enter the bladder only after unusual depression of the handle indicates enlargement of the middle lobe over which the point of the instrument has to be raised. The facility with which a coudée catheter enters the bladder in such a case also points in the same direction.

The presence of an enlarged middle lobe, or of a bar at the neck of the bladder in senile enlargement of the prostate, may also be detected by means of the cystoscope.

Urethra.—This may be examined from without by inspection and palpation, or from within either by

inspection with a urethroscope, or much more commonly by palpation by means of a sound, bougie, or catheter.

The urethra, from its close proximity to the under surface of the penis, readily permits of digital palpation along its whole length. Induration about a stricture, abscess, or impacted stone may thus readily be felt. In young children a stone impacted at the anterior end of the urethra often causes an acute œdema of the prepuce, while at the same time the swelling thus produced causes the stone to be less easily felt.

The perineal region should always be carefully palpated in connection with supposed disease of the urethra, since it is here that abscesses connected with inflammatory disease of the urethra are especially apt to occur. A deep-seated abscess in the perineum, connected with stricture, often presents itself in the form of an exceedingly hard, well-defined swelling, which to the uninitiated may not suggest the presence of pus.

The examination of the interior of the urethra is usually made with sound, bougie, or catheter, which enables the observer to localise and measure any narrowing that there may be.

By means of a metallic instrument, an impacted calculus may be detected. The urethroscope may afford useful information by revealing the face of a stricture, the presence of ulceration, &c., but it is an instrument of far less value than the corresponding one which is employed for the inspection of the bladder.

CHAPTER XXI.

PYURIA AND HÆMATURIA.

THE occurrence of pus or blood or both in the urine either alone or in combination with other signs and symptoms of disease, is so common that it seems desirable to devote a chapter to the consideration of these two signs of disease. Either blood or pus may be derived from any part of the urinary tract from the kidney to the external orifice of the urethra, or may proceed from disease primarily outside that tract, but opening secondarily into it.

Blood in the urine indicates a breach of surface in some part of the mucous membrane of the urinary tract. Such a breach may be extremely minute, as in the case of hæmorrhage due to mere congestion or inflammation of the mucous membrane itself. More often the hæmorrhage is derived from a larger breach of surface, such as an ulcer exposing small or even large blood-vessels. Granulations bleed readily, especially when subjected to slight injury, such as that caused by the contraction of the bladder.

The vessels of a new growth are very prone to give way and to bleed on slight provocation. Papilloma of the bladder, carcinoma of the bladder, sarcoma of the kidney are familiar examples of tumours which

often cause profuse hæmaturia. The bleeding that results from gross mechanical injury, such as that produced by the introduction of some instrument (catheter) or from external violence, needs no further mention.

Pus in the urine may be derived from a simple inflammation of the mucous membrane, as in the earlier stages of gonorrhœa for example.

When in considerable quantity it generally indicates an ulcerated condition of some part of the urinary tract.

The urinary organs themselves may be the sole cause of the suppuration, or the pus may be derived from an abscess cavity itself outside the urinary tract, but opening into some part of that tract, usually the bladder. The occurrence of pyuria in connection with caries of the hip or spine is a familiar example.

In most cases of either pyuria or hæmaturia we shall do well to consider more or less separately, (i) the situation of the lesion, *i.e.*, from what part of the urinary tract the pus or blood is derived; (ii) the nature of the lesion.

(i) **Situation of the Lesion** causing pyuria or hæmaturia.

Urethra.—When pus or blood in quantity are derived from the urethra, there is usually but little difficulty in determining the source of the discharge. The discharge of pus or blood independently of the act of micturition shows that the urethra is the seat of the lesion. During micturition it is the first few drops of urine alone that contain the abnormal constituent, the rest of the urine being clear or nearly so. A cutting pain along the course of the urethra during the act of

micturition may also point to a local seat of inflammation.

A history of injury to the urethra either from the outside, or more often from the inside, from the use of some instrument, may indicate clearly enough the source of a hæmaturia.

A careful examination of the urethra and perineum both from the outside, and, if necessary, from the inside, by catheter, bougie, urethroscope or other instrument, may reveal the cause of a pyuria or a hæmaturia.

In connection with the urethra, the prostate must not be forgotten. Suppuration in the prostate often makes its way into the prostatic urethra and thence to the exterior. Abscess originating outside the prostate, in the perineum or between the rectum and bladder, may also discharge into the prostatic or other part of the urethra. The importance of a rectal examination in cases of obscure pyuria or hæmaturia is obvious.

With regard to pyuria it is well to remember that a patient may wilfully deny the existence of any symptom or history pointing to disease of the urethra. The doubtful origin of a long-continued slight pyuria has before now been cleared up by the detection of a stricture or a small ulcer of the urethra.

In the case of women it is well to remember that blood or pus in the urine may be derived, not from the urinary tract at all, but from the vagina or even uterus.

Bladder.—Blood or pus coming from the bladder is frequently associated with definite bladder symptoms, such as frequency of micturition, pain in the perineum, or hypogastrium, or at the end of the penis. Blood or pus having a vesical origin is nearly always more or less intimately mixed with the urine.

The presence of clots of blood in the urine is more often seen in cases of vesical than of renal hæmorrhage.

If the vesical lesion which causes the pyuria or hæmorrhage is associated, as it so often is, with cystitis, the presence of mucus in the urine and other signs of cystitis are of importance in the diagnosis. Alkalinity of the urine and the presence of phosphatic crystals usually indicate vesical inflammation. The existence of cystitis does not, however, exclude the possibility of the pus or blood being derived from the kidney.

Direct examination of the bladder with the sound or cystoscope, or with the finger in the rectum may aid in the diagnosis. In some cases even an exploratory operation (suprapubic cystotomy) may be desirable.

Ureter and kidney.—The **ureter** as a source of pyuria or hæmaturia can clinically scarcely be distinguished from the kidney. In some few cases, however, other evidence of disease of the ureter, such as the palpation of a stone impacted in its lower end, may indicate the exact situation of the disease.

The kidney is probably the seat of the disease if there is distinct enlargement of that organ, or if there is characteristic renal pain.

The absence of any evidence of disease of the urethra or bladder may point to the kidney as the seat of a pyuria or hæmaturia. The presence of casts in the urine naturally indicates disease of the kidney.

Long filiform clots of blood indicate that these have been formed in the ureter, and point to disease of the kidney.

Actual inspection of the vesical ends of the ureters often affords clear proof not only that the blood or pus

comes from the ureter or kidney, but also of the side from which it comes. Inspection of the ureters may be effected either by the electric cystoscope or directly by Kelly's endoscope.

(ii) The Nature of the Lesion.

This may be conveniently discussed under the following four heads: (*a*) Simple inflammation. (*b*) Tuberculous disease. (*c*) Calculus. (*d*) New growth.

In the vast majority of cases the presence of blood or of pus in the urine is due to one or other of these four classes of disease.

Diseases outside the urinary tract, such as pelvic abscess, causing pyuria or even hæmaturia by extension to the urinary tract, need not be further discussed, since their diagnosis depends rather upon the existence of special signs and symptoms indicative of those diseases.

(*a*) Simple inflammation of the kidneys (nephritis and pyelitis) belongs rather to the domain of the physician than to that of the surgeon. The existence of general symptoms of renal disease, together with the presence of albuminuria and casts, are generally sufficient for the diagnosis of disease of the kidney substance.

Simple pyelitis, that is pyelitis not due to tubercle or calculus, generally occurs either in association with nephritis or as a secondary result of cystitis, the inflammation spreading upwards along the ureter to the pelvis of the kidney.

The differential diagnosis of a simple pyelitis is made partly by the detection of a cause for the pyelitis, such as a spinal injury or disease, or the existence of a

previous cystitis; partly by the absence of signs pointing directly to tubercle or calculus.

Simple cystitis, that is cystitis not due to tubercle, calculus, or new growth, is due to bacterial invasion, either from the urethra, as in a case of gonorrhœa, or from surrounding parts, as in the case of an inflammatory affection spreading through the wall of the bladder, or occasionally from inflammation spreading downwards along the ureter. The occurrence of cystitis is favoured by the presence of certain abnormal conditions of the spinal cord, such as injury or inflammatory diseases. The bladder, thus deprived of the normal trophic influences exerted upon it by the spinal cord, readily becomes a prey to bacterial invasion.

As in the case of pyelitis, the differential diagnosis of a cystitis resolves itself into ascertaining the cause of the cystitis. A cystitis in the first instance should usually be regarded as a symptom of some other disease, and should be looked upon as a primary disease only when all other possible primary causes, such as foreign body, calculus, tubercle, new growths, and affections of the spinal cord, have been carefully considered and excluded.

(*b* and *c*) The differential diagnosis between **tuberculous and calculous disease** both of the kidney and of the bladder often presents the greatest difficulties. This is not surprising when we reflect that in both cases the main symptoms are those of ulceration of the kidney or bladder. The ulceration is produced in the one case by the breaking down of tuberculous deposits in the mucous membrane and submucous tissues, in the other by the mechanical injury caused by the rough stone.

With regard to the pyuria and hæmaturia produced by both these diseases, it may be stated that the former is more characteristic of tubercle, the latter of calculus. Exceptions are, however, not uncommon. A large stone lying quietly in the kidney may cause profuse pyuria with little or no hæmaturia.* On the other hand, in exceptional cases of tubercle both of the kidney and of the bladder, but especially of the former, the tuberculous process may extend so deeply as to involve vessels of some magnitude, and profuse hæmaturia may ensue.†

The presence in the urine of crystals on the one hand, of tubercle bacilli on the other, may be of much assistance in the diagnosis.

For the detection of tubercle bacilli, the use of a centrifugaliser, or the experimental injection of the sediment into a guinea-pig, may be desirable.

The past history or the family history of the case may afford help by pointing to the probability of tubercle or of stone respectively. X-rays may also afford conclusive evidence of stone in the kidney, ureter, or bladder.

Finally, direct examination of the bladder by the sound may reveal a stone; examination by the cystoscope, electric or other, may show tubercle. If the kidney be the seat of the disease, an exploratory operation alone may suffice for a correct diagnosis.

With regard to enlargement of the kidney, it is well

* A case of this kind was under my care in the Royal Free Hospital a few years ago. A girl æt. 15 had had persistent pyuria for thirteen years, but had only very rarely had hæmaturia. A large branched calculus was removed from the pelvis of the kidney.

† I have seen a young woman die after repeated attacks of profuse hæmaturia, due to tuberculous disease of the kidneys and bladder. Pyuria had been a much less prominent feature of the case.

to remember that stone in the pelvis of the kidney causes enlargement of that organ by blocking the ureter. A stone in one of the calyces does not block the ureter, and consequently does not cause enlargement. A smooth stone firmly lodged in the upper end of the ureter may produce much enlargement of the kidney without necessarily producing either pyuria or hæmaturia.

The presence of a perinephritic abscess is more likely to indicate tubercle than calculus, since tubercle is more likely to affect the substance of the kidney. Stone naturally affects the interior.

(*d*) **New growth.**—Painless, profuse, and intermittent hæmaturia without other symptoms almost always indicates the presence of a new growth either in the kidney or the bladder. Pyuria is not a prominent feature, although it may occur if the growth be ulcerated, or if there be accompanying cystitis.

In various acute inflammatory affections painless hæmaturia may occur, but is usually to be distinguished from the hæmaturia of new growth by the presence of other symptoms, such as albuminuria, and by the absence of intervals of complete intermission, which are so characteristic of the early stages of new growth.

If the presence of a new growth be complicated by the existence of cystitis or other inflammatory condition, the difficulties of diagnosis are much increased.

The diagnosis between innocent and malignant new growths in their early stages is often very difficult. It should be remembered that malignant growths of the urinary tract are much more common than innocent ones, especially in persons of middle or advanced age. In the absence of definite evidence of innocent new

growth, the presumption is therefore always in favour of malignancy. The positive evidence of innocency is to be found in the duration of the hæmaturia, and in the discovery of the actual tumour, either by the cystoscope, or by the examination of detached portions of growth which have been voided with the urine or have come away after the introduction of an instrument, such as a catheter or lithotrite. Delicate villous processes seen in either of these ways usually indicate innocent new growth. It must not, however, be forgotten that a growth, which at first sight is apparently merely villous and innocent, sometimes proves to have malignant elements in it, and is found to run the clinical course of a malignant tumour.

Long duration of the symptoms points unmistakably to innocency. Intermittent hæmaturia extending over a period of many years is a common history of papilloma of the bladder. On the other hand, an epithelioma of the bladder may exist for many months, or even a year or two, without causing any marked involvement of the general health.

Rectal examination may afford important evidence of the existence of a malignant new growth of the bladder; a hard mass felt at the base of the bladder or elsewhere generally points unmistakably to malignancy.

Innocent growths, being usually small and soft, cannot be detected by rectal examination. Intravesical examination by speculum, cystoscope, or cystotomy may be necessary before an exact diagnosis can be made.

CHAPTER XXII.

DISEASES OF THE SCROTUM AND ITS CONTENTS.

In the investigation of a scrotal swelling, we have first to determine the structure or tissue in which it is situated.

Thus it may be a swelling of

(*a*) The skin or cellular tissue,
(*b*) The tunica vaginalis,
(*c*) The testis,
(*d*) The spermatic cord.

On the other hand, it may be a swelling which has originated altogether outside the limits of the scrotum, and has only come secondarily to occupy that part. Such are hernial swellings, and for the diagnosis of swellings of this nature see chap. xvii.

In the examination of any swelling of the scrotum or genital organs it is well to make a thorough inspection not only of these parts themselves, but also of surrounding parts, such as the lower abdomen, the groins, and upper parts of the thighs, since disease may there be found which will throw light upon the nature of the scrotal swellings.

After inspection of all these parts it is best to examine systematically with the fingers and thumb the

testis and cord of each side, as well as the skin and other tissues.

The fingers should be placed behind the scrotum, the thumb in front of the upper portion of it, and the patient told to cough. In this way it is generally easy to determine whether the swelling is limited to the scrotum and its normal contents, or whether it extends upwards out of the scrotum, *e.g.*, along the cord, or whether it is a hernia or other swelling descending into it from above.

If it is clear upon examining in this way that the fingers and thumb can be so closely approximated above the swelling, that there is nothing between them but normal structures, such as the spermatic cord, then it may be concluded that the swelling belongs to one or other of the first four above-mentioned groups.

If the cord alone is felt to be enlarged, this may be due either to the spread of inflammation or of new growth along it as in epididymitis, or sarcoma of the testis, or to mere hypertrophy of the cremaster due to the weight of the swelling below. Every swelling of the testis or tunica vaginalis, which has existed sufficiently long, tends to cause some hypertrophy of the cord by which it is suspended.

The condition of the cord should be carefully compared with that of the opposite side.

The condition of the upper part of the scrotum and the spermatic cord having been investigated, attention should next be directed to the testis itself and its coverings.

At an early stage of the examination it should be ascertained whether both testes are in their normal situation. Mistakes in diagnosis frequently occur in

connection with misplaced testes owing to omission of this simple observation.

A general swelling of the whole scrotum is very rarely due to distension with air or with blood. Distension by air is seen only in rare cases of injury to the thorax (fractured ribs with wound of lung), in which the air extravasated into the cellular tissue has made its way down to the scrotum. The condition is easily recognised by the extreme lightness of the scrotal swelling, its resonance on percussion, and the crackling sensation imparted to the examining finger, as well as by the history and the existence of emphysema of the cellular tissue elsewhere.

Distension with blood is seen only in cases of injury; the condition is easily recognised by the dark colour of the swelling and by the history of injury.

Much more common causes of general swelling of the scrotum are œdema and inflammation acute and chronic.

General œdema of the scrotum may be merely a part of a general œdema, connected with disease of the kidneys or heart.

Acute inflammation of the cellular tissue of the scrotum may be due to phlegmonous inflammation (erysipelas) starting in a wound of the scrotum or spreading to it from surrounding parts. Or it may be due to the presence of an abscess or to extravasation of urine. Erysipelatous inflammation, being above the deep fascia, shows no tendency to be limited to the scrotum and perineum, but spreads to the neighbouring regions of the thighs.

Inflammation set up by extravasation of urine, or by the presence of an abscess of the perineum, is limited sharply behind and on either side by the attachments

of Colles's fascia, and tends to spread forwards only, into the penis and scrotum and up on to the front of the abdomen. The examination of the urethra, prostate and rectum may throw much light upon the origin of acute inflammation of the scrotum.

Chronic swelling of the whole scrotum is often seen in connection with urinary fistulæ of long standing. Repeated attacks of inflammation of the scrotum often lead to a sort of chronic hypertrophy that has been called spurious elephantiasis.

It is in cases of true elephantiasis that the greatest amount of chronic swelling and thickening of the scrotum is seen. The history of residence in the tropics, the chronic nature of the swelling, the absence of any urethral trouble, and, if necessary, examination of the blood for filaria, will usually suffice for a correct diagnosis.

In any case of scrotal swelling, whatever its cause, an attempt should be made to localise the testes and cords, and to ascertain whether there is any disease in these organs.

Localised swellings in the cellular tissue and unconnected with the testes are rare. Lipomata and other innocent tumours occasionally occur in this region, but are usually easily recognised by the ordinary character of such tumours.

Localised abscesses of the scrotum are common, but as they are almost always due to disease of the testis, they are directly connected with this organ, and cannot be separated from it.

A swelling limited to the spermatic cord is occasionally a tumour, such as a lipoma. In the vast majority of cases, however, a swelling in this situation is due to

local dilatation of the unobliterated tunica vaginalis (hydrocele of the cord). It presents itself as a rounded smooth swelling inseparable from the cord. A hydrocele of the cord situated very low down may be so close to the testicle as to simulate a swelling of the testis itself (encysted hydrocele of the epididymis). The hydrocele of the cord can, however, almost always be made to move apart from the testis. The hydrocele of the epididymis cannot be separated from the testis. Translucency is usually obtainable in both varieties of encysted hydrocele and reveals the cystic nature of the tumour. A simple tapping will reveal the presence of a straw-coloured fluid if the hydrocele be of the cord, that is, derived from the peritoneal process.

A hydrocele of the epididymis, on the other hand, contains a watery fluid of low specific gravity, often with a milky tinge due to the presence of spermatozoa in it.

Swellings of the tunica vaginalis are due to distension with serous fluid or with blood (vaginal hydrocele or hæmatocele).

In both cases the swelling surrounds the testis, which is felt indistinctly at the back and lower part of the swelling, or is not felt at all. Translucency is usually enough for the diagnosis of a hydrocele. If the wall is, however, very thick, this sign may not be available. But in this case, the very long duration of the swelling will suggest a hydrocele. Or a tapping will reveal the presence of clear fluid. In infants a hernia may be translucent to a certain extent.

Hæmatocele is generally more rounded than the hydrocele, which is usually oval or pyriform. It is often distinctly heavier than the hydrocele. It is never

translucent. The overlying skin and cellular tissue may be discoloured, especially if the hæmatocele is recent; a history of injury is usually obtainable. Tapping may be necessary before the diagnosis is clearly established.

It should be remembered that both hydrocele and hæmatocele may be merely secondary to disease of the testis itself; the condition of the latter organ should always be ascertained if possible.

A favourable opportunity for examination of the testis is presented immediately after the withdrawal of fluid by tapping. Both hydrocele and hæmatocele may be very closely simulated by soft elastic swellings of the testis itself (*e.g.*, soft sarcoma), especially if the tests of translucency and tapping have not been applied.

Swellings of the testis itself have, however, but seldom the uniform smoothness of a swelling which is due to the accumulation of fluid within the tunica vaginalis.

In the examination of a swelling of the testis itself an attempt should always be made to feel the epididymis. Swellings involving mainly the epididymis are usually either inflammatory, due to the spread of inflammation along the vas deferens (as in gonorrhœal epididymitis), or they are due to the local deposition of tubercle. In either case the vas deferens will probably be found to be thick and hard.

A swelling which involves the body of the testis and not the epididymis is probably either syphilitic or a malignant new growth. In the diagnosis between tuberculous and syphilitic diseases of the testis, the history and the existence of lesions in other parts of the body may throw much light on the nature of the affection.

Tuberculous disease of the testis is especially apt to be accompanied by disease of other parts of the urinary organs; examination of the vesiculæ seminales per rectum, of the kidneys by palpation, and of the urine, are therefore important factors in the diagnosis.

A tendency to the formation of abscess in or close to the testicle points to tubercle.

A very hard painless testicle is probably syphilitic.

The presence of hydrocele with a solid enlargement of the testis generally points to syphilis, but is also not very uncommon in connection with tubercle.

The presence of hæmatocele with a solid enlargement of the testis is suggestive of malignant disease, especially if no history of injury is obtainable.

Solid tumours of the testis originate almost invariably in the body of that organ. Innocent tumours are very rare, and are to be diagnosed chiefly by the very slow but steady growth; enchondroma is, perhaps, the least uncommon, and is characterised by its extreme hardness. Malignant disease is on the other hand only too common, and is frequently very difficult to diagnose. Steady and rapid increase in size of a swelling originating in the body of the testis is extremely suggestive of new growth, in the absence of anything pointing directly to inflammation. In the earliest stage, before the tunica albuginea has been perforated, there may be a certain amount of pain, which lessens when the growth is more free to expand. As soon as the growth has extended beyond the tunica albuginea, the growth tends to become irregular. A painless swelling that is soft and elastic in some parts and harder in others is likely to be a malignant new growth. A soft elastic new growth of moderate size is likely to be mistaken on the

one hand for a fluid swelling (hydrocele or hæmatocele), from which it is most readily distinguished by the absence of translucency or by the result of tapping. A hæmatocele yields dark altered blood, a malignant tumour nothing at all or at most a few drops of fresh blood. Malignant disease is, on the other hand, often closely simulated by chronic or subacute inflammatory affections, such as syphilitic disease or tubercle affecting the body of the testis.

It is important to remember that the lymphatics from the testis pass to the lumbar glands and not to the inguinal, which receive those of the scrotum. Affections of the testis therefore tend to cause enlargement of lumbar glands, while those of the superficial parts tend to involve the inguinal glands.

In conclusion, the reader may be reminded that the coexistence of two or more diseases in the scrotum is very common. Thus, hernia may occur with hydrocele, or either of these with varicocele, and so on.

The diagnosis of a single diseased condition does not by any means necessarily complete the diagnosis of the whole case.

CHAPTER XXIII.

DISEASES OF BONE.

Congenital malformations of bone present little or no difficulty in diagnosis. A bone may be congenitally small or rudimentary as in the case of so-called intra-uterine amputations, where one or more of the bones of a limb is represented by a mere irregular fragment of bone.

It may be congenitally malformed—*e.g.*, the vertebræ in a case of spina bifida, the pelvis and femur in a case of congenital dislocation of the hip.

It may be congenitally enlarged, as in the case of the phalanges in macrodactyly.

Atrophy of bone likewise presents but little difficulty in diagnosis. The bone is more slender than normal, as in the bones of a limb in which chronic joint disease has existed for a long time. Disuse of the bone is the main cause of atrophy. A limb that has long been the seat of infantile paralysis shows atrophy of all its bones. The bones of a bed-ridden patient generally show atrophy for the same reason.

Local atrophy or absorption from pressure may be produced by anything that presses continuously for a long time upon the part. An innocent tumour lying in close contact with a bone may lead to a hollow in

the neighbouring portion of the bone. A slowly growing fibrous tumour of the naso-pharynx may cause much atrophy of the superior maxilla. The atrophy of the bodies of the vertebræ from the pressure of an aneurism is a familiar instance.

The atrophy produced by the pressure of an innocent tumour must be distinguished from the destruction of a bone by the invasion of a new growth. A sarcoma of the femur eats into and destroys the bone, but this is not atrophy.

Softening of bones is produced by certain general diseases, of which the most familiar is rickets. A much less common and little understood disease attended by marked softening of adult bones, is osteomalacia (mollities ossium).

A softened bone naturally tends to yield and to become bent. Hence the bent bones so characteristic of rickets.

Unnatural **hardening** of bone is almost always produced by chronic inflammation (sclerosis). Unnatural brittleness of bone is sometimes produced, however, by certain nervous diseases as locomotor ataxy, and perhaps by chronic rheumatoid arthritis. The frequent occurrence of fracture of the patella in the same patient on one or both sides of the body, can sometimes be explained only on the supposition that the bones are preternaturally brittle.

General enlargement of a bone may be due to mere hypertrophy, compensatory in nature. Thus congenital absence of the tibia causes hypertrophy of the remaining fibula, owing to the increased strain thrown upon that bone.

Certain general diseases such as acromegaly are

attended by great enlargement of some of the bones; the cause of this enlargement is ill understood.

Osteitis deformans is another disease characterised by the slow and painless enlargement of certain bones, notably the tibia and the skull. All the bones of the skeleton tend, in time, to become affected. The disease, although possibly inflammatory in nature, differs from most inflammatory affections of bone in being wholly unattended by pain or by any of the other symptoms that usually accompany inflammation of bone.

Deformity of a bone, especially of a long bone, is caused by fracture, by bending, by various forms of inflammatory swelling, and by the growth of tumours within the bone or springing from it.

Local swelling of a bone is due in the vast majority of cases, either to some form of inflammation or to the presence of a tumour.

Inflammatory affections of bone.—The diagnosis of an inflammatory affection of a bone is to be made partly by the general symptoms of septic absorption, partly by the presence of signs and symptoms elsewhere of some general disease such as syphilis, tubercle or rheumatism, and partly by the local signs.

The general symptoms of septic absorption vary according to the acuteness and infectivity of the local inflammation.

Thus in the most acute form of osteitis, the infective osteitis (acute infective periostitis, acute necrosis), general symptoms of blood-poisoning set in early. They are mainly high temperature, rigors, flushed face, quick pulse, and then pleurisy, pericarditis, or some other evidence of a general visceral septic infection.

The local signs are those of inflammation more or less marked as the bone is or is not superficially situated.

Thus acute osteitis of the tibia is attended by pain, tenderness, and swelling of the neighbouring soft parts. Redness and œdema of the skin is generally an early sign of acute osteitis of a superficial bone, such as the tibia or clavicle. If a deep-seated bone such as the humerus or femur be the seat of disease, the skin may be unaffected for a long time. The deep-seated swelling around the bone causes, however, a general thickening of the limb and tension of the skin. In some cases the deep swelling of the limb causes an actual blanching of the skin, which is tightly stretched over the deeper parts.

Local and deep tenderness, which may be very acute, is the most valuable sign of acute osteitis.

Acute osteitis or periostitis of a long bone is most likely to be mistaken for an inflammation of the soft parts over the bone. The deep-seated tenderness and the fact that the inflammatory area corresponds exactly to the situation of the bone will generally serve to distinguish the affection of the bone from other more superficial inflammations.

An erysipelatous or other acute cellulitis of the leg may at first resemble an acute osteitis of the tibia. The erysipelatous inflammation is, however, not limited to the area of the tibia, whereas the inflammatory swelling due to disease of the bone is in the main so limited, and is most marked over the part where the bone is nearest to the surface.

Scurvy rickets, with its attendant effusion of blood beneath the periosteum, is extremely likely to be confused with acute periostitis, especially as both are prone to occur in children. Scurvy rickets is, however, more

likely to occur in very young children at an age when acute periostitis is less common. The multiple lesions of the former disease, together with the general symptoms of the disease and probably the absence of the very acute local symptoms, will generally help in the diagnosis.

Acute periostitis affecting an epiphysis often closely resembles an acute inflammation of the neighbouring joint. It can generally be distinguished by careful observation of the exact seat of the swelling, which is close to the joint rather than at the joint. There is also less likelihood of the movements of the joint being seriously interfered with. It must not be forgotten, however, that an affection primarily of the epiphysis may also involve the articulation. Sometimes careful attention to the history will indicate the exact date at which the epiphysial inflammation extended to the joint.

The diagnosis of the more chronic inflammatory affections of bone generally resolves itself into the diagnosis of a local inflammation of bone, and the diagnosis of the cause, such as tubercle, syphilis, or injury; the two former showing probably evidence elsewhere of their existence, the latter by the history or by marks of injury.

Abscess of bone may be diagnosed, or at least strongly suspected, by dull localised pain at the end of a long bone, with some local thickening and local tenderness. There may or may not be elevation of temperature. The existence of œdema over the affected part is corroborative of abscess in the bone beneath.

The diagnosis between tumours (new growths) and inflammatory affections of bone is often exceedingly difficult. The difficulty is increased if the tumour happen to be also inflamed.

The history of a new growth is that of a steadily increasing swelling; a slow increase in size if the tumour be innocent, more rapid if it be malignant. Tumours in their early stages rarely cause any symptoms except those which may be caused by the mechanical effects of pressure.

Inflammatory swellings are generally accompanied by some general symptom of the disease which is the cause, or by some point in the history which will indicate inflammation. On the other hand, a malignant tumour may be attributed to a local injury. In their early stages, tumours which develop within a bone may cause considerable dull aching pain. It is also well known that a malignant tumour growing under conditions of tension may cause a distinct elevation of temperature.

With regard to local signs, it may be stated that as a general rule a tumour stands out prominently from the bone, and does not involve any great length. It has usually a tolerably well-defined or even abrupt margin, whereas inflammatory swellings more often shelve off into the surrounding bone. An actually overhanging edge is exceedingly characteristic of an innocent bony tumour, the common exostosis of the femur, for example.

A swelling which arises abruptly from an otherwise healthy bone is not at all likely to be of an inflammatory nature. Tumours which originate within the bone and expand it have not the same abrupt margin. A myeloid sarcoma, for instance, has not the same well-defined edge that the periosteal sarcoma presents. A tumour covered with a thin shell of bone, such as a myeloid sarcoma, often presents a very characteristic sign, that of "egg-shell crackling" of the thin bony layer that covers it.

The difficulty of diagnosis between inflammatory affections and malignant tumours is greatly increased when the swelling affects a deeply-seated bone, such as the femur or the ilium. The muscles and other soft parts cover up the swelling, and render exact palpation difficult. Sarcomata affecting the shaft of a long bone, such as the femur, may thus appear to have a fusiform shape and simulate inflammatory swellings.

Occasionally a considerable mass of inflammatory bone may surround a small sequestrum, and, in the absence of reliable history, may easily simulate a sarcoma.

In some cases the diagnosis is impossible until after an incision has been made into the tumour. Even then it has sometimes been found that inflamed soft tissues have resembled sarcomatous tumours so closely that amputation has actually been performed in the belief that it was being done for a malignant tumour. The inflammatory tumour that is most likely to be mistaken for a sarcoma is that which surrounds a small piece of necrosed bone. Necrosis may occur very quietly and without external suppuration, and the absence of any acute symptoms may thus give rise to the diagnosis of tumour.

The use of the Röntgen rays may help in the diagnosis between a tumour and an inflammatory affection. It is, however, not a very reliable means of diagnosis. In a well-marked case of tumour, however, in which a considerable portion of bone has been eaten away by the growth, the skiagram may be very characteristic.

"Spontaneous" fracture—that is, fracture from a very slight degree of violence—always indicates weakness of the bone at the seat of fracture. Nearly always

it means the presence of a malignant new growth in the bone, either a primary sarcoma or a secondary carcinoma. Its occurrence should always raise a strong suspicion of new growth, and should lead to a careful examination to see whether any evidence of a local tumour can be detected, or of a primary carcinomatous tumour elsewhere.

Spontaneous fracture does not necessarily indicate new growth. It is sometimes due to tuberculous disease (caries or necrosis) which has weakened the bone. Tertiary syphilitic disease sometimes produces the same effect. Necrosis not due to tubercle does not as a rule lead to fracture, because of the compensating new bone that is thrown out around the necrosed portion. "Spontaneous" fracture is occasionally due to mere brittleness of the bone, as in some cases of locomotor ataxy, and in the atrophied bones of elderly subjects.

CHAPTER XXIV.

DISEASES OF JOINTS.

The physical examination of a joint should be made, as far as possible, when the latter is in a state of rest. If the neighbouring muscles and tendons are thoroughly relaxed, the examination of the underlying joint is facilitated. Thus a knee should be examined when the leg is lying in the extended position, with the foot or the whole limb supported by the bed, couch, or chair.

The examination should not be confined simply to the most accessible part of a joint, but should include all its aspects. Thus, much can often be learnt about a knee-joint by examination of its posterior aspect, by passing the fingers deeply into the popliteal space, the muscles being at the same time relaxed by flexing the knee. Similarly, disease of the shoulder-joint may often be investigated with advantage by passing the fingers up into the axilla. In this situation the joint is more accessible to direct examination than it is on its outer or superficial aspect, where it is covered by the thick deltoid muscle.

In investigating the condition of a joint we have to consider the following points, which may be discussed seriatim :

I. Pain.
II. Presence of swelling in or near the joint.
III. The relative position of the bones that enter into its formation.
IV. The condition of the muscles surrounding it, especially as regards wasting and spasm.
V. The movements.

I. **Pain** felt in a joint may be due to disease of the joint itself or to disease of the bones or soft parts in close proximity to the joint; or it may be due to disease of some other part, the pain being merely referred to the joint.

Pain of the last kind is usually easily detected by the complete absence of any local sign of disease in the joint in which the pain is felt, together with the presence of signs of disease in some other part which is really the seat of disease.

The pain in the knee, which is such a familiar symptom of hip-disease, affords a good illustration; so does the pain in the hip, which is a common symptom of disease of the lumbar or sacral spine.

Pain due to disease of bone or soft parts in close proximity to the joint, is generally diagnosed without much difficulty by the presence of local swelling or tenderness at the seat of disease.

A constant dull pain, not increased by movement of the joint, generally indicates disease of the unyielding bone rather than of the softer structures of the joint.

The pain that is most characteristic of disease of a joint, and especially of ulceration of the articular end of one of the constituent bones, is the so-called starting pain. This symptom, when present, is a valuable indication of active inflammatory disease. It occurs

suddenly, just as the patient is dropping off to sleep, and is due to the relaxation and then spasm of the surrounding muscles. The relaxation of the muscles allows the bones to separate slightly, the subsequent spasm brings the inflamed surfaces violently into contact, and causes the attack of sharp pain. This symptom is sometimes said to indicate ulceration of articular cartilage. It betokens rather that the bone beneath the cartilage has been exposed by the destruction of the cartilage over it. It is the inflamed bone that is tender, not the ulcerated cartilage.

II. **Presence of swelling.**

(*a*) Within the joint—(i) Effusion of fluid.
(*α*) Synovia.
(*β*) Blood.
(*γ*) Pus.
(ii) Solid—loose cartilage.
(*b*) Of the synovial membrane.
(*c*) In the neighbourhood of the joint.
(i) In the articular ends of the bones.
(ii) In the soft parts outside the joint.

(*a*) Swelling within the Joint.

(i) Effusion of Fluid.—(*a*) Synovia.

An effusion of fluid into a joint, if sufficiently great, causes an enlargement which may be obvious to sight and touch, if the joint be large and superficial, such as the knee-joint. If the joint be deeply seated, such as the hip, the swelling is naturally less easily detected, unless the amount of fluid be considerable.

It is in cases of chronic effusion, in which the synovial membrane has become distended by the intra-articular pressure, that the swelling attains its greatest size.

An effusion into a joint causes a swelling which preserves the natural shape of the synovial cavity. This shape may be exceedingly characteristic. The horseshoe-shaped swelling of the knee-joint, most marked above and on either side of the patella, is the best example that can be adduced. The swelling of an effusion into the ankle, at the front and back of the joint, and around each malleolus, less prominent where it is bound down by more or less rigid structures such as the tendo Achillis behind and the extensor tendons in front, is also a good example.

There are, however, two exceptions to the rule that an effusion causes a uniform distension of a joint. One is the rare case in which the fluid accumulates in a part only of the joint, the rest of the cavity having been shut off by adhesions or obliterated by previous disease. The other is the also somewhat rare case in which a local yielding of the synovial membrane occurs, allowing the fluid to protrude at one or more places in the form of a rounded or even pear-shaped swelling.

Such local protrusions are most common in connection with the knee, and may extend for several inches down the leg among the muscles of the calf (Morrant Baker's cysts). Occasionally the narrow communication between the cyst and the joint becomes completely closed, so that the protrusion exists as an independent cyst. The diagnosis may generally be made without difficulty if the communication still exists, by pressing the fluid back into the joint. If the cyst is independent of the joint, the diagnosis is more difficult; but the situation near a joint, and probably, some evidence of fluid or other disease in the joint itself, will

generally suffice for a diagnosis. Tapping of the cyst, and the evacuation of straw-coloured oily fluid resembling synovia, may be necessary before the diagnosis can be established with certainty.

A hip-joint occasionally presents a large rounded prominent swelling of this nature on its anterior aspect, lifting up or displacing to one side the femoral artery.

These local dilatations of a joint are most often associated with chronic rheumatoid arthritis.

A simple effusion into a joint is caused either by some purely local change, such as inflammation of the synovial membrane, injury, &c.; or it may be due to some general blood-poisoning, using this term in its widest sense. The synovial cavity of a joint communicates freely with the lymphatic vessels, and is to be regarded as a dilated portion of the lymphatic system, similar in this respect to the pleura, peritoneum, and other large serous cavities of the body. It is easy therefore to understand why a general infection, such as pyæmia, or acute rheumatism, displays a tendency to cause inflammation of, and effusion into, joints. More chronic forms of blood-poisoning, such as gonorrhœal rheumatism, syphilis, and tuberculosis, show a similar tendency to infect joints, but in a less severe degree.

(β) **Blood** within a joint almost always indicates a recent injury. It is often a sign of a fracture of a neighbouring bone, the line of fracture running through the cartilage into the joint. Thus fractures of the lower end of the humerus or the upper end of the tibia are often accompanied by an effusion of blood or blood-stained fluid into the elbow or knee.

A spontaneous effusion of blood into a joint rarely occurs except in hæmophilia, the diagnosis of which is made chiefly by the previous history and by the family history. Blood within a joint generally causes after a short time some dusky discoloration of surrounding parts, especially if the joint be large and superficial, as the knee. Very rarely the presence of blood within a joint is due to the penetration of the joint by some malignant growth. This sign of a malignant growth is, however, never seen except in late stages, when the diagnosis is no longer a matter of doubt.

Considerable distension of a joint coming on very rapidly, say within an hour, generally indicates an effusion of blood. Distension occurring more slowly usually indicates an inflammatory effusion.

(γ) The diagnosis of **pus** within a joint is generally made partly by the constitutional signs, such as elevation of temperature denoting septic absorption, and partly by the severity of the local signs, such as tenderness. If the inflammation have made its way through the synovial membrane into surrounding tissues, then œdema, redness, or other signs of local suppuration may afford valuable indications of the probable presence of pus within the joint. It must not be forgotten, however, that pus, especially in cases of tuberculous disease, may exist, even in considerable quantity, within a joint, and yet give rise to little or no constitutional disturbance, and to but few local signs. In such cases the diagnosis between serous and purulent effusion may be possible only after the aspirator has revealed the exact nature of the fluid.

The presence of pus within a deeply-seated joint, such as the hip, frequently gives no definite sign of

its presence until the fluid has made its way through the capsule and formed a definite swelling in the neighbourhood of the joint. Occasionally such local collections of pus form outside a diseased joint without any direct communication with its interior. They may originate in the substance of the thickened synovial membrane or outside it. But more often such collections will be found to have a direct communication with the interior of the joint itself.

(ii) **Solid.**—The loose cartilage, the only solid substance found within a joint, is usually easily diagnosed by the history and by the physical signs. Loose cartilages are found almost exclusively in the knee-joint, but occasionally occur in the elbow and even in other joints. So long as the cartilage does not get caught between the ends of the bones, it causes no symptoms. But when this accident does occur, a sharp, sudden, sickening, and severe pain is produced, and the joint may become locked. An effusion into the joint usually follows, and may last for a few days or even weeks. This effusion may hide the cartilage and render its palpation difficult. A history of this kind should, however, lead to a strong suspicion of loose cartilage, even if the cartilage itself cannot be felt. But usually, careful examination of the joint reveals the presence of one or more loose bodies slipping about inside the joint.

Sometimes the cartilage is more or less fixed by a stalk to the synovial membrane. The presence of rheumatoid arthritis also helps towards a diagnosis.

The dislocated semilunar cartilage presents symptoms somewhat similar to that of the true loose cartilage. There is, however, in these cases always a history of

injury; the joint is more likely to be locked when the cartilage becomes displaced, and the displacement can often be felt by direct examination. A transverse depression or elevation at the side of the joint, usually the inner side, and just where the femur and tibia meet, show that the semilunar cartilage has become displaced.

(*b*) **Swelling of synovial membrane.**

Chronic inflammation of a joint, and especially tuberculous inflammation, leads to general thickening and swelling of the synovial membrane. If the joint be deeply seated, as the hip, it may be impossible to feel this or to feel more than, at most, an indistinct fulness in the region of the joint.

If, however, the joint be large and superficial, then the thickened synovial membrane can easily be felt and recognised. The shape of the joint whose synovial membrane is swollen is exactly the same as that which is distended with fluid. The former has, however, a more doughy feeling, and the latter may give a definite sense of fluctuation. Frequently the two conditions of thickened membrane and fluid in the joint co-exist, and diagnosis may be very difficult.

In the case of the knee-joint, riding of the patella affords an excellent means of detecting fluid. In the case of other joints, the sense of fluctuation may be sufficiently marked to establish the correct diagnosis.

Irregular local thickening of synovial membrane is occasionally seen in cases of syphilitic joints. The diagnosis of this disease affecting a joint depends more, however, on the existence of characteristic lesions in the skin, mucous membranes, bones, viscera, and elsewhere.

The presence of hard local thickenings, nodules, or

plates of bone in the synovial membrane or capsule of a joint usually indicates chronic rheumatoid arthritis. The diagnosis is confirmed by the ridges of bone ("lipping") felt at the margins of the articular cartilages.

(*c*) **Swelling in the neighbourhood of the joint.**

The examination of (i) the **articular ends of the bones** may reveal important changes associated with joint disease. Indeed, the primary seat of a chronic inflammation may be in the neighbouring epiphysis, the joint affection being secondary. The degree of severity of a case of chronic joint disease may to a certain extent be gauged by the extent of implication of the neighbouring bone or bones.

(ii) Swellings in the soft parts near a joint always demand careful examination of the joint itself. Thus a chronic abscess below the head of the tibia or in the upper part of the thigh may be the most prominent feature of a case of tuberculous disease of the knee or hip respectively.

The more or less detached synovial cysts connected with chronic rheumatoid arthritis have already been mentioned.

III. **The relative position of the bones** which enter into the formation of a joint is a point to which attention should be drawn. As a general rule, in all inflammatory affections of joints the bones are held in a flexed position, the position of greatest ease. Such is the case with disease of the knee, hip, and elbow. An inflamed wrist-joint, on the other hand, is usually kept in the straight extended position.

A still more important sign of joint disease indicating

destructive disease is the abnormal relation of the axes of the bones to one another.

The threefold displacement of the tibia upon the femur in a case of advanced disease of the knee is the best example that can be given. The tibia tends to be displaced backwards and outwards, and also to be rotated outwards. The displacement of the trochanter upwards and backwards towards the dorsum ilii in a case of hip disease is a similar example. In both these cases the displacement indicates erosion and absorption of bone, due either to caries or to chronic rheumatoid arthritis. Very great absorption and deformity, often with free mobility and little or no pain, should suggest disease of the central nervous system as a cause of the joint disease (*e.g.*, Charcot's disease, due to locomotor ataxy).

IV. **Condition of the muscles surrounding a joint.**—The muscles around a joint that is acutely or subacutely inflamed are in a state of **spasm**. The contraction of the muscles serves to fix the joint and to keep it at rest. In early hip disease, for example, the fixity of the joint, from spasm of the muscles, is one of the most important signs.

Wasting of the muscles may be due to mere disuse, and may occur in the case of any joint that has been kept quiet for a long time. Wasting of muscles becomes, however, an important sign of disease when it sets in early, and is quite out of proportion to the disuse of the joint.

Tuberculous disease of a joint usually produces marked wasting within a very few weeks of its onset.

V. The **movements** of a diseased joint may be:

(*a*) Restricted by mere spasm of muscles, as mentioned in the preceding paragraph, due to

active disease; by voluntary action on the part of the patient, as in hysteria, or from dread of pain, real or imaginary; by adhesions around the joint.

Extra-articular adhesions, the result of inflammation among the muscles or tendons, may fix a joint almost completely.

Adhesions in the joint due to previous inflammation may be slight, as after a mild attack of synovitis, or may be so extensive and dense as to firmly unite the bones together (fibrous ankylosis). Ankylosis in children, however firm, is scarcely ever due to bony union. But in adults joint disease that has been attended by destruction of articular cartilages is frequently followed by true bony ankylosis.

It is well to remember that in rare cases bony ankylosis may follow very slight and insidious disease of a joint.

A swelling of any kind in the neighbourhood of a joint may cause restriction of movement without the joint itself being diseased. Thus, a tumour, innocent or malignant, springing from the lower end of the femur or from the pelvis, may mechanically prevent the free movement of the neighbouring joint. In such cases the diagnosis is made partly by feeling the tumour itself, and partly by noticing that the movement of the joint is perfectly free and natural up to a certain limit; when this limit has been reached, further movement is suddenly arrested by contact with the tumour.

(*b*) **Unnatural mobility** of a joint may be due to mere relaxation of ligaments, tendons or muscles. The joints of a paralysed limb may be unduly movable.

Long continued traction upon a joint may cause looseness of the joint from stretching of the ligaments. Thus, weight extension applied for many months or years to a case of hip disease may cause considerable weakening of the corresponding knee, especially if the weight has been excessive, or if care has not been taken to apply the traction to the thigh rather than to the leg alone.

Destructive disease of the bony portions of a joint, if not counteracted by inflammation and adhesions, causing fixity, may lead to much unnatural mobility. Lateral movement at the elbow, knee or ankle, which, in the extended position, does not occur normally, is an important and bad sign of destruction of the ends of the bones. It is commonly seen in advanced tuberculous and other inflammatory affections of these joints, also in some cases of chronic rheumatoid arthritis, attended by much erosion of bone. Unnatural mobility of a joint is seen in its most marked form in Charcot's disease, where the erosion of bone may have been so extensive that the joint presents a flail-like appearance, being freely and painlessly movable in all directions.

Grating during movement of a joint may be due merely to roughness of articular cartilage, as in rheumatoid arthritis, or to roughness of the synovial membrane, as in many forms of dry arthritis.

In its most marked form, however, grating indicates erosion of cartilage and exposure of the underlying bone. This form of grating is common in advanced caries of the joint, in rheumatoid arthritis, and in Charcot's disease.

CHAPTER XXV.

DISEASES OF THE SPINE.

In investigating a case of disease of the vertebral column the surgeon should direct his attention especially to the following points:

The **shape** of the spine, with special reference to any curvature or other deformity.

The **movements** of the spine, noticing whether they are restricted in any way, and especially whether they are attended with pain.

The existence of any **nervous symptoms** indicating involvement of the spinal cord or of the nerves proceeding from it.

The existence of any **local swelling** connected with or springing from the vertebræ (abscess, new growth, &c.).

Shape of the Spine.

In order to examine thoroughly the shape of the spine the patient should be undressed and the whole spine from sacrum to occiput thoroughly exposed to view. In the case of young children it is best that they should be stripped naked. In the case of adults they should be undressed down to the waist.

Women and others who are sensitive about so thorough an exposure of the body should then be told to put their arms through the sleeves of the dress or coat, so that the front of the trunk is covered while the whole of the back is nevertheless freely accessible to examination.

The patient should at first be examined in the upright position, whenever this is possible.

If the patient, however, is suffering from a painful or acute disease of the spine, it may be undesirable or impossible to make him adopt the vertical position.

The examination must then be conducted with the patient sitting up or lying upon one side. In extreme cases it may be necessary to make the examination so as to ensure the least possible disturbance of the spine; this may have to be done by passing the hand under the spine while the patient lies on his back.

In order to make the position of the spinous processes more obvious, it is a good plan to rub the fingers two or three times up and down the spine. This causes temporary redness of the skin over the spinous processes, and renders their exact position more readily visible. The fingers should be passed carefully along the grooves on either side of the spinous processes, and any irregularity or tenderness noted.

A general backward curvature of the whole spine, or, at any rate, of the dorsal and lumbar portions of it (kyphosis), is common in young children, and is due merely to rickets or to general weakness. It is usually easily diagnosed by the absence of pain, and by the fact that the spine is perfectly flexible. When the child is lifted up by the shoulders the abnormal curvature disappears entirely. When this curvature has

existed for a long time it becomes more or less permanent, and the spine loses some of its flexibility.

The question may then arise whether the curvature may not be due to some more serious disease, such as caries. The diagnosis is generally made by noticing that the curve is a general and uniform one, as well as by the absence of other signs characteristic of caries.

The general backward curvature which is so commonly seen in old people, and which is due mainly to a prolonged maintenance of the stooping position, is characterised by a similar uniformity in the curve, but in these cases the spine is almost always rigid, and cannot be restored to its normal position. If pain occurs in such a spine it is often due to chronic rheumatoid arthritis.

Kyphosis and rigidity of the spine are also marked features of osteitis deformans.

A general curve with the concavity backwards (lordosis) is seen only in the lumbar region, and is not an indication of any disease of the spine itself. It usually means some affection of the hip, such as ankylosis in a flexed position, or congenital dislocation. The curvature of the spine is simply secondary. It is due to the rotation of the pelvis round a horizontal transverse axis, which is necessary before the flexed thigh can be brought into the vertical position.

The characteristic feature of the curvature due to caries of the spine is the point or angle seen at the most prominent part of the curve. A definite sharp prominence in the line of the spine indicates that the spine is sharply bent. A sharp bend in the spine can be produced only by absorption of the bodies of a limited number of vertebræ. Such absorption and destruction of bone is caused only by tuberculous caries or by the

much rarer malignant disease. The curvature produced by malignant disease is indistinguishable, by the shape of the spine alone, from that which is caused by tubercle. It is, however, generally not difficult to arrive at a correct diagnosis by observation of the greater severity of the pain, by the short history, by the age of the patient, and by other signs of malignancy. Caries of the spine starting at an advanced age is sometimes mistaken for malignant disease, and *vice versa*.

In some few cases of chronic caries involving a considerable number of vertebræ, the sharp angle above mentioned is not present. Several spinous processes project prominently backwards and form a rounded protuberance. Such cases may at first present some resemblance to scoliosis (so-called lateral curvature), but may be distinguished by the greater and more local degree of curvature, and usually by the abnormal straightness of the rest of the spine above and below the projection.

In some cases, on the other hand, the amount of curvature may be extremely slight, and may consist in little more than a slight prominence of a single vertebra. A single prominent vertebra, especially if associated with rigidity or unnatural straightness of the neighbouring portion of the spine, is highly suggestive of absorption of the bodies of one or more vertebræ, that is, of tuberculous caries (or possibly malignant disease).

True lateral curvature of the spine is rare, and is seen chiefly in cases in which one side of the chest has recently become contracted as the result of pleurisy or empyema.

The common deformity to which the name of "lateral curvature" is usually applied is not a true or simple

lateral curvature, but a combination of a certain amount of lateral curving with a great deal of twisting of the vertebral column (hence the name scoliosis).

Simple kyphotic curvatures unattended by rigidity, as well as pure lateral curvatures in young people, are apt to pass into a condition of scoliosis. In scoliosis the line formed by joining the tips of all the spinous processes shows more or less deviation from the vertical. It is well to remember that this line does not represent the true amount of lateral curvature, since the rotation of the vertebræ tends to throw the bodies outwards and the spinous processes inwards towards the middle line. The apparent curvature, as shown by the spinous processes, is therefore less than the real one.

In the diagnosis of scoliosis, evidence of this rotation should be looked for. The transverse processes on the convex side of the curve are more prominent, being rotated backwards, while those on the concave side, which are rotated forwards, are less prominent.

The ribs follow the dorsal vertebræ to which they are attached, and are rotated backwards on the convex, forwards on the concave, side of the curve. Deformity of the chest and alteration in the shape of the ribs themselves are necessarily produced by the same rotation. The forward displacement of the ribs sometimes leads the patient to complain primarily of a "lump in the chest," or even of a "tumour in the breast," rather than of anything wrong with the spine, of which she may be wholly unaware. Inspection by means of the Röntgen rays affords a good means of seeing the actual amount of lateral curvature that is present.

The diagnosis of a well-marked case of scoliosis

presents no difficulty. Evidence of the rotation above mentioned is sufficient to establish the diagnosis.

In some few cases scoliosis leads to the complaint of pain, and this pain may lead to the suspicion of caries. The pain, however, is rarely more than a feeling of weakness or discomfort, and is quite unlike the more severe pain usually felt in the acute stages of caries.

A difficulty sometimes occurs in diagnosis in those cases in which scoliosis has followed upon, and coexists with, caries; in these cases careful examination will generally reveal some of the special signs and symptoms indicative of caries.

Movements of the Spine.

The spine in health is a flexible structure, capable of bending freely in the anterio-posterior direction, and permitting a considerable amount of rotation. With advancing age the spine tends to become less flexible. To test the movements of the spine the patient should stand with his back to the surgeon, who grasps the pelvis firmly with both hands. The patient should then bend the body first forwards, then backwards, as far as possible, and then rotate it, looking first over one shoulder then over the other. Or the patient may be seated on a couch; the surgeon, seated, places one hand firmly against the sacrum, and tells the patient to bend backwards until the head touches the couch; then forwards until the head is between the knees. The perfectly healthy spine should thus be thrown into a regular curve, concave and convex respectively, backwards.

Another method of testing the freedom of movement

of the spine is to direct the patient, standing with the heels together, to pick up any small object, such as a book or a bunch of keys, from the floor, and to observe how he does this, whether easily and naturally or with hesitation, stiffly, slowly, and carefully. This is a test not so much of deformity of the spine as of painful rigidity, and is chiefly useful in the detection of early acute caries.

The spine may be stiff from actual ankylosis of the vertebræ, as in rheumatoid arthritis or old caries; or from rigidity and spasm of muscles, as in all cases of acute or subacute inflammatory and other painful diseases of the spine.

Local tenderness on percussion is sometimes a valuable indication of caries of the spine in the early stages before actual deformity has presented. Of local sensitiveness to heat, as applied by a hot sponge, the same may be said.

Nervous Symptoms.

The intimate connection between the vertebral column and the spinal cord and nerves contained within it naturally leads in many cases to the production of nervous symptoms.

Any disease which causes absorption and consequent falling together of vertebral bodies (*i.e.*, tuberculous caries and, more rarely, malignant disease), tends to diminish the size of the intervertebral foramina through which the corresponding spinal nerves pass. It is the irritation of spinal nerves thus produced that is the main cause of the peripheral pain which is so common a symptom of caries of the spine. The pain is referred

to the peripheral distribution of the spinal nerves that are thus involved at their proximal ends. Hence the pain at the back of the head (occipital) in upper cervical caries, the pain at the front of the chest in upper dorsal, in the front of the abdomen in lower dorsal caries, the pains about the hips and down the thighs in caries of the lumbar and sacral regions.

A child who complains of persistent stomach ache, for which no abdominal cause can be discovered, should always be suspected to have disease of the spine, and a thorough examination of that part should follow.

Malignant disease is likely to involve spinal nerves or nerve roots, either by pressure or by direct infiltration. The pain produced is usually excruciating and persistent, being much more severe than that of tuberculous caries. It is, moreover, less likely to be relieved by the recumbent position.

Mere bending of the spine without actual disease of the bones does not usually affect either the spinal cord or the nerves.

Nor does the curve of caries, as a rule, cause nervous symptoms referable to pressure on the spinal cord, because the curvature is produced slowly, and the cord has time to accommodate itself to the altered shape of the vertebral canal. When symptoms of pressure upon the cord do occur in connection with caries, they are almost invariably produced by the pressure of inflammatory products upon the spinal cord and not by the pressure of bone.

The soft tuberculous matter tends to be squeezed backwards against the cord by the pressure of superincumbent vertebræ.

The beneficial effect of rest in the horizontal position

upon the pressure symptoms in most cases in which these symptoms have only recently supervened is well known.

Occasionally pressure upon the cord is produced by a definite chronic abscess within the vertebral canal, between the body of the vertebra and the theca vertebralis.

Occasionally a spread of inflammation from the bones to the meninges, cord and nerves is the cause of the nervous symptoms.

In the case of fracture of the spine causing paraplegia the case is different. Here it is almost always the bone itself that presses upon or cuts into the spinal cord; or the cord may be compressed by the effusion of blood into the vertebral column.

The earliest and most common symptoms of pressure upon the cord are exaggeration of tendon reflexes (knee jerks) if the seat of pressure is above the lumbar enlargement, and paraplegia. The latter may consist merely of slight weakness of the legs, or may be of any degree of severity up to complete paralysis of the lower limbs. Sensation is retained, as a rule, long after motor paralysis has become complete.

Malignant disease, like caries, produces also exaggeration of reflexes and paralysis of the limbs. But the disease being progressive, the nervous symptoms are not likely to diminish as the disease advances. Nor are they so likely to be favourably influenced by the adoption of the recumbent posture. Malignant disease is also more likely to pick out individual nerves and nerve-roots, and severe pain is almost always associated with the other symptoms.

It need scarcely be said that disease, whether tuber-

culous or malignant, when affecting the lumbar enlargement or the nerves below this, does not cause exaggeration of reflexes, but rather diminution of them.

Local Swellings.

Local swellings in connection with diseases of the spine are practically of two classes: those which are inflammatory, and those which are new growths. Besides these there are certain congenital swellings such as spina bifida, the diagnosis of which usually presents no difficulty. Tumours springing from the spine seldom form swellings that can be seen or felt from the back until a late stage of the disease has been reached, when the diagnosis is no longer doubtful. Nearly all tumours of the spine originate in the bodies of the vertebræ. In their growth they may extend backwards into the spinal canal, causing symptoms of pressure upon the spinal cord, or they may project laterally or anteriorly, pressing upon the structures nearest to them. The pressure effects are similar to those of the much more common inflammatory swellings, which may now be considered.

In every case of suspected caries of the spine a careful examination should be made to ascertain whether an abscess exists or not. It must be remembered that an abscess in connection with caries of the spine may form very insidiously and give rise to no acute symptoms, such as pain or elevation of temperature.

If the abscess makes its way to the back of the spine it may form an obvious swelling, situated usually somewhat on one side of the middle line.

Such an abscess does not usually present much difficulty in diagnosis.

But if the evidence of disease of the spine is not plain, a deep-seated abscess in this region may be mistaken for a fatty tumour or other growth. This is especially likely to occur if the abscess presents over the ribs at some little distance from the spine. Care may have to be taken to distinguish the spinal abscess from abscess connected with local disease of a rib and from an empyema pointing backwards. It need scarcely be said that empyema is occasionally secondary to caries of the dorsal spine.

An abscess originating in the cervical spine may remain in front of the vertebræ, and in this situation it may be detected by careful examination of the back of the pharynx, by direct inspection, or by palpation with the finger. Or if a little lower down out of reach of the finger in the pharynx, its presence may be detected by the pressure it exerts upon the œsophagus or pharynx, causing difficulty in swallowing; or even by the displacement forwards of the larynx and trachea. Such abscesses can, however, usually be detected by careful deep palpation from the outside, the larynx and trachea being pushed gently to one side.

A post-pharyngeal abscess connected with caries of the spine may be simulated by an abscess due to some other cause, such as a foreign body (pin or fishbone).

Not very uncommonly does the pus from a suppurating tonsil make its way behind the pharynx and present as a post-pharyngeal abscess, causing probably much difficulty both in swallowing and breathing; such an abscess is, however, never situated strictly in

the middle line, being always more or less on the side of the tonsil from which it came. Gummata in the soft tissues behind the pharynx and new growths springing from the vertebræ or elsewhere occasionally simulate abscesses of spinal origin. Abscesses connected with disease of the cervical spine seldom remain in front of the vertebral bodies, but tend to make their way laterally to the side of the neck, where they can be detected by careful deep palpation. Such abscesses are most likely to be confused with abscesses due to tuberculous glands. The difficulty in diagnosis may be much increased in those cases in which the spinal symptoms are ill-marked, and in those in which enlargement of lymphatic glands secondary to the spinal caries also exists.

In every case of suspected caries of the upper dorsal or lower cervical spine, careful palpation should be made at the root of the neck, just above the sternum on either side of the trachea. The abscess that forms in connection with the dorsal spine may be very difficult to detect if it does not pass either backwards, or downwards into the lumbar region. Careful auscultation and percussion will, however, sometimes reveal the presence of an abscess at the side of the dorsal spine if sufficiently large. Or it may be suspected, if not actually diagnosed, by the pressure it exerts upon the œsophagus. Or it may involve the pleura, and thus give rise to physical signs.

All spinal abscesses have a tendency to gravitate downwards. In every case of spinal caries, therefore, deep palpation of the lumbar region should be made. Even if no actual collection of pus can be felt, the contraction of a psoas muscle, shown by the flexion of

the hip, may lead to a strong suspicion of abscess. In the lumbar region a perinephritic abscess often closely resembles that of spinal caries.

Abscess connected with sacral or lower lumbar caries may be detected by careful examination per rectum.

Abscesses connected with spinal caries may pass through the sacrosciatic foramen into the buttock, simulating an abscess connected with the hip-joint, or into the perineum, forming a very serious variety of ischiorectal abscess. The occurrence of a spinal abscess in the upper part of the thigh or even still lower down is too well known to require more than a passing mention.

An impulse on coughing, which is a common feature of spinal abscesses which have made their way to the back, loin, thigh, or elsewhere, merely indicates a connection with the interior of the thorax or abdomen, and is, of course, not peculiar to spinal abscesses.

The use of the Röntgen rays in connection with scoliosis has already been mentioned on p. 262. They are also often of very great use in the diagnosis of caries of the spine and of malignant disease. Absorption of bone and deposition of new bone may be readily made out by their means. The difficulty of obtaining accurate X-ray photographs of deeply seated structures such as the lumbar spine has perhaps led to their employment for the diagnosis of caries of the spine to a less extent than is desirable. In many doubtful cases of caries of the spine without marked deformity, absolute and clear proof of the nature of the disease is at once afforded by an X-ray photograph.

CHAPTER XXVI.

DIAGNOSIS OF ENLARGED LYMPHATIC GLANDS.

The diagnosis of the lymphatic glandular nature of a swelling or group of swellings generally presents but little difficulty. The **situation** of the swelling or swellings in some part where lymphatic glands are known normally to occur naturally helps in the diagnosis. Thus, the anterior and posterior triangles of the neck, the axilla, the front and inner part of the upper arm just above the inner condyle, the groin and the popliteal space are the regions in which glandular swellings usually occur. Enlargement of the more deeply placed glands in the interior of the body, such as the mediastinal and lumbar glands, present greater difficulties in diagnosis on account of their inaccessibility.

Multiplicity is another important feature of enlarged glands. Diseases that affect lymphatic glands usually cause enlargement of several of them. A chain of little swellings in one of the above-mentioned situations is almost certain to be lymphatic glandular. Even when the disease at first sight appears to consist of a single swelling, it will generally be found, on careful examination, that similar but smaller swellings exist in

close proximity to the larger one, and will give a clue to its nature.

A single, small, rounded, or oval swelling in a situation where glands normally occur is probably a gland, unless there is a distinct reason to the contrary.

A large mass composed of a number of glands more or less matted together is generally to be diagnosed by its lobulated appearance, even if neighbouring separate glands cannot be detected. There are, however, rare cases in which tumours not connected with glands occur in groups or chains. The multiple neuro-fibromata of the neck, connected with the cervical and brachial plexuses, may be cited as an example.

Lobulated tumours such as fibro-lipomata occasionally simulate masses of enlarged glands. They can usually be distinguished by their softness, by the absence of inflammatory adhesions and by the absence of neighbouring isolated glands. In many cases the diagnosis of the glandular nature of the swelling is made less from the physical character of the swelling than from the concomitant inflammation. Thus an acute inflammatory swelling in the groin or axilla may present merely the characters of an abscess. That the abscess is due to inflammation of glands might be inferred, however, from the existence of an inflamed sore upon the foot or hand, the starting-point of lymphatic absorption.

In investigating the nature of any supposed glandular swelling it cannot be too strongly insisted upon that a careful examination should be made of the neighbouring skin and mucous membrane, from which glands in this situation normally derive their lymphatics.

Thus a sore upon the head or face may be the cause

of cervical glandular enlargement; upon the arm, chest, or back, of axillary enlargement; upon the abdomen, perineum, genital organs, lower limb, &c., of enlargement of glands in the groin. Disease upon the cutaneous surface of the body is less likely to escape observation than disease situated upon the mucous membrane of internal cavities. How often do we see simple, tuberculous, or malignant, glandular swellings of the neck, the primary cause of which lies in a hitherto undetected affection of the mouth, pharynx or œsophagus!

Although some glandular swellings are due to disease primarily affecting the glands themselves, yet, in the vast majority of cases, the primary cause is to be sought elsewhere. Frequently, too, the treatment of the glands resolves itself into the treatment of the primary cause.

Extreme hardness of the glands denotes either malignant or very chronic inflammation. The hardest of all glands are those which have become calcified. The long history will usually indicate the true nature of the affection. Chronically inflamed but not calcified glands tend to be hard in proportion to the amount of fibrosis that they have undergone. Acutely inflamed glands may be hard, but are easily diagnosed by the pain and tenderness.

A form of glandular enlargement attended by considerable induration but of very short duration is that which is found accompanying the primary sore of syphilis. The resemblance between submaxillary glands of this nature and those of malignant origin occasionally presents some difficulty, especially in elderly people. The diagnosis has to be made by

careful attention to the history as well as to the characters of the local sore on the lip, tongue, or elsewhere.

Although malignant glands are almost always hard, there are cases in which such glands are very soft. Thus the glands of lymphosarcoma are sometimes so soft as to resemble broken-down tuberculous glands. Such glands have even been known to be incised, under the mistaken idea that an abscess was present.

Again, large masses of secondary epithelioma may be so broken down and soft as to simulate abscess.

The resemblance to abscess is very much greater if to the growth a septic element is superadded. Primary epitheliomata of the mouth, pharynx, penis, and other parts which are likely to have a very foul surface are especially likely to cause sepsis and consequent breaking down of the secondary glands.

Chronically enlarged glands that have rapidly enlarged and softened are very likely to contain pus, even when none of the more obvious symptoms of suppuration are present. Tuberculous glands in the neck, for example, are often found to contain pus in the interior of them.

The question often arises whether a given swelling of the neck is a mass of glands or whether it is a chronic abscess. The question is to be answered partly by the softness and feeling of fluid within the lump, partly by accurate observation of its situation. A swelling, for instance, which lies partly over and partly under the sterno-mastoid, curving round its anterior or posterior border, is probably an abscess, certainly not a single gland.

Glands that are the seat of simple septic inflammation generally either rapidly subside when the primary

source of infection has been treated, or else they suppurate. In either case the acuteness of the symptoms usually suffices for a diagnosis.

The more chronic forms of inflammation are usually due to tubercle or syphilis. The diagnosis has to be made mainly by the evidence of other manifestations of the disease elsewhere. Tuberculous glands show a marked tendency to progress slowly and comparatively painlessly and to suppurate. Syphilitic glands have much less tendency to suppurate. When superficial, the former have a marked tendency to cause a bluish purple discoloration of the overlying skin.

Lymphadenomatous glands are generally to be diagnosed by their steady increase in size and, except in the latest stages, by little or no tendency either to become adherent to each other or to neighbouring parts, or to suppurate.

A mass composed of a number of glands of considerable size which move freely upon each other and upon surrounding parts is much more likely to be lymphadenomatous than tuberculous.

In some cases of doubt as to the nature of a group of enlarged glands it may be desirable to remove a gland and subject it to microscopical or bacteriological examination.

CHAPTER XXVII.

DIAGNOSIS OF ANEURISM.

An aneurism is diagnosed partly by its physical signs, partly by the symptoms to which it gives rise.

When the aneurism is easily accessible to direct examination, as in the case of an aneurism of one of the limbs, the physical signs are of most importance. If the aneurism, however, be deeply seated, as within the cranium or in the thorax or abdomen, where its physical characters are less easily observed, then the symptoms to which it gives rise, and especially the pressure symptoms, become proportionately of more importance.

An aneurism, being a local dilatation of an artery, must be situated in the line of an artery. As most aneurisms, with the exception of cerebral and pulmonary aneurisms, spring from large arteries, the **situation** of the tumour in or close to the line of some known artery is the first point in the diagnosis. The tumour, moreover, being attached to the artery cannot be separated from it. Containing as it does, in nearly all cases, fluid blood in direct communication with that of the interior of the artery from which it springs, an aneurism **pulsates**. The pulsation is expansile. In this respect it differs from that which is merely

communicated to a tumour lying in direct contact with a large artery. Many tumours of the neck which are not aneurismal pulsate markedly, owing to the presence of the underlying carotid artery. If such a tumour be soft, or if it contain fluid, it may easily be mistaken for an aneurism.

Sarcomata and other tumours sometimes have large arteries running over them. The pulsation of such arteries thus superficially placed may be very easily felt, and may lead to error if care be not taken to observe whether the pulsation is expansile and involves the whole of the tumour.

Chronic and slight distension of the hip-joint from rheumatoid arthritis sometimes lifts up the common femoral artery and forms a tumour which apparently pulsates and which may be mistaken for an aneurism of that artery.

In some few cases a malignant tumour may be so permeated with large arteries that a certain amount of true expansile pulsation exists in it. The amount of expansile pulsation in such cases is, however, so very slight that it ought not to lead to error. Besides, there are usually other points about the case which serve to make the diagnosis clear.

The amount of expansile pulsation in an aneurism naturally varies according to the fluidity of the aneurismal contents. An aneurism with a thin wall and almost wholly fluid contents pulsates strongly. One which is nearly or wholly filled up with clot pulsates little or not at all. A cured aneurism, which has shrunken in size and is represented merely by a mass of partially absorbed blood clot and connective tissue, may present great difficulties in diagnosis. It may

easily be mistaken for a fibrous or other innocent tumour.

An aneurism may become **inflamed,** and if the skin over it be reddened, tender and perhaps œdematous, the resemblance to an abscess may be considerable. The similarity may be increased by the fact that the inflammation of the aneurism is likely to lead to clotting of the blood within it, thus rendering the pulsation less obvious. Cases are by no means unknown in which such aneurisms have been incised in mistake for abscess, sometimes with disastrous results.

Occasionally an abscess will erode the wall of an artery. Blood then passes into the abscess cavity, and a false aneurism is formed. If the previous suppuration has led to the formation of scars over the tumour, the resemblance of such a tumour to a simple abscess is heightened.

Aneurisms usually produce a systolic **bruit** which forms an important diagnostic sign. It varies much in degree and intensity, and may be completely absent. It is simulated by the factitious bruit produced by the pressure of any tumour upon a neighbouring artery. Tumours at the root of the neck, *e.g.*, thyroid cysts, often present loud bruits from the pressure which they exert upon surrounding large vessels.

Such factitious bruits are easily produced in normal arteries, such as the abdominal aorta or the common femoral, by pressing lightly upon them with the stethoscope.

A bruit transmitted from a valvular lesion of the heart may also be mistaken for an aneurismal bruit. An aneurismal bruit is usually loud and harsh, but has in itself nothing quite characteristic.

Another important physical sign of an aneurism is that the **tumour diminishes in size** when pressure is made upon the artery supplying it. The extent to which the tumour can thus be diminished in size will depend upon the amount of fluid blood within it, and also to a certain extent upon the thinness and compressibility of the aneurismal wall.

When the pressure is taken off the artery, the aneurism speedily returns to its original size, as the blood is again driven into it by successive beats of the heart. This refilling of the sac, "per saltum," felt by the hand placed upon the tumour, is exceedingly characteristic.

The mere presence of the aneurismal tumour may lead to **a feeling of weight and oppression,** as in the case of some large thoracic aneurisms. A feeling of stiffness in the knee-joint may be the first sign of a popliteal aneurism. Any aneurism occupying the flexure of a joint tends by its bulk to limit the movements of that joint. Most aneurisms of the limbs are situated in the flexures of joints.

Dulness on percussion, of little value in the diagnosis of aneurisms of the limbs, becomes of much importance in connection with the diagnosis of those which are in the neighbourhood of air containing viscera. Thus, a patch of dulness over the upper part of the sternum, or at the back of the thorax, may be an important sign of aneurism.

The other signs and symptoms of an aneurism are those which are produced by the pressure of the aneurismal tumour upon surrounding parts.

In the case of aneurisms of the limbs, pressure may be exerted upon the main artery, causing **weakness of the pulse below.**

Inequality of the radial pulses is a common accompaniment of an aneurism of the arch of the aorta, causing pressure upon the innominate or subclavian artery.

Pressure upon nerves may cause pain down the leg in a case of popliteal aneurism. Similar pain down the arm or along the course of an intercostal nerve is often produced by aortic aneurism.

Paralysis of the left recurrent laryngeal nerve or of the sympathetic nerve, as shown by the paralysed condition of the vocal cord and the contraction of the pupil and of the palpebral fissure, are well-known signs of intrathoracic aneurism. Pressure upon neighbouring **veins and lymphatics** is also not uncommon, and may lead to congestion and œdema of the parts below. Pressure upon the **œsophagus, trachea, bronchi,** or even upon the **lung** itself, often produces characteristic symptoms which may be of much service in the diagnosis of intrathoracic aneurism.

Intracranial aneurisms may sometimes be diagnosed, or at least suspected, if careful attention be paid to the cerebral symptoms produced by their pressure. Aneurisms at the back of the orbit are more easily diagnosed, since their pulsation can be detected, and their pressure effects upon the eye and cellular tissue of the orbit and eyelids are often easily recognisable.

PART III.

INJURIES.

CHAPTER XXVIII.

EXAMINATION AND DIAGNOSIS OF INJURIES IN GENERAL.

THE diagnosis of a case of recent injury depends usually upon the application of common sense to anatomical knowledge.

When called to a case of injury the surgeon should first seek to ascertain what part or parts of the body have been damaged. This he may do by questioning the patient himself, or by questioning bystanders who may have witnessed the infliction of the injury.

He must further ascertain in many cases whether the clothes show any evidence of the exact cause of the injury. Thus the muddy marks of a cartwheel upon a coat or the perforations of a garment by a bullet may afford valuable evidence as to the precise situation of an abdominal contusion, or the probable track of a bullet respectively.

He will do well also to find out what was the immediate result of the accident, whether the patient's symptoms

came on at once or gradually, and what these symptoms were.

Next, he must examine carefully the person of the injured patient, and must remember that the mere examination of an injured part may inflict further damage unless care be taken to avoid doing so.

Thus rough examination of a fracture may result in making it compound; injudicious probing of a wound may start serious hæmorrhage, or set up sepsis; and so on.

If there is an external wound the surgeon should ask himself what structures are likely to have been involved, and examine to see whether there is any evidence of their having been injured. Especially important is it to ascertain whether any internal cavities have been involved, or if any important structures, such as viscera, main arteries, or nerves have been wounded or not.

He must remember that more than one injury may have been produced at the same time, and must therefore be on his guard against assuming that the first injury that he discovers is the sole or even the most important lesion.

CHAPTER XXIX.

INJURIES TO THE HEAD.

I. **Injuries to the soft parts outside the skull** usually present but little difficulty in diagnosis.

A few points only need be mentioned.

Contusions of the scalp in some cases simulate a depressed fracture of the skull, the centre of the contusion being soft, while the periphery presents to the examining finger a harder ring or edge, which by the unwary may be taken for an edge of fractured bone.

Apart from the special signs and symptoms usually presented by a depressed fracture, the diagnosis between the two conditions may usually be made in the following manner. If the forefinger be placed on the centre of the swelling it will generally be found possible, in the case of a mere contusion, to feel firm resisting underlying bone when the finger has been depressed sufficiently firmly and deeply. If, however, the finger can be depressed below the level of the surrounding bone, then there must be a depression of the bone—that is, a fracture.

In the case of wounds about the face, care should be taken to notice whether any cavity has been opened, and whether the wound involves the facial nerve or Steno's duct.

II. Injuries to the soft parts inside the skull.

In every case of injury to the head, even when apparently trivial, attention should be directed to the state of the soft parts inside the skull, that is, the brain. The brain may be damaged with or without fracture of the skull, but in either case there may exist symptoms pointing directly to a cerebral lesion.

Practically, as the result of an injury to the brain, there may ensue one or other of three states: (*a*) Concussion; (*b*) Compression; (*c*) Irritation. Each of these has its own group of symptoms, although not infrequently those of two or more may be combined.

(*a*) In **concussion** the most marked feature is insensibility coming on instantaneously, at the time of the injury. The patient's face is pale, his pulse is feeble, and his respiration shallow, his temperature probably subnormal.

(*b*) In **compression**, whether from depression of a fractured piece of bone, or from hæmorrhage, or, later, from the accumulation of inflammatory products, there is a different group of symptoms.

There is insensibility, but this does not necessarily come on at the time of the accident. If due to the gradual accumulation of blood or other fluid, it comes on gradually or gradually deepens.

The face is often congested, the breathing is usually slow, heavy, and stertorous, owing to the paralysis of the soft palate and other muscles. The pulse is probably full and bounding, and has a tendency to be slow. There is often paralysis of one or more limbs or groups of muscles. The sphincters tend to be relaxed.

In most cases the insensibility produced by concussion

has not passed off before that due to compression sets in, and it is sometimes very difficult to say how far the insensibility is due to the one or the other condition. In some cases of compression due to hæmorrhage, there is a characteristic interval of consciousness or partial consciousness intervening between the time of the accident and the supervention of the symptoms of compression.

(*c*) Cerebral **irritation** is shown by a tendency to restlessness and to spasmodic movements of various muscles. It is most often due to laceration of the surface of the brain, and the signs and symptoms are most characteristic when the lesion affects the motor area of the cerebral convolutions. In such cases spasmodic movements may be seen in the limb or group of muscles whose cortical centre is situated at the injured spot.

III. **Injury to the bones of the cranium.**

Fracture of the skull is diagnosed partly by direct examination of the broken bone, partly by inference from the concomitant damage that has been inflicted upon the brain and other soft parts within the skull, and upon the cranial nerves passing through the bone. In some cases (especially in fractures of the base) important evidence is derived from the escape of the fluid contents of the skull.

As a rule it may be stated that fractures of the vault of the skull are usually diagnosed by direct examination of the broken bone. In fracture of the base, on the other hand, the diagnosis is made almost entirely by inference and by the evidence derived from the brain or cranial nerves, or from the escape of fluids from the interior of the skull.

Fractures of the **vault** of the skull, which are more

or less accessible to direct examination, are usually diagnosed by sight and touch. A depression can be felt, an edge or ridge of bone is palpable, a fissure can be seen or felt. In compound fractures the examination of the bone is most easily made.

In every case of supposed injury to the bones of the skull a full and careful examination of the whole vault should be made. If there is a wound this should also be most carefully examined with both finger and probe. Care must of course be taken that both are thoroughly clean before they are inserted into the wound. A crack in the bone is best detected with a probe or finger nail; a depression with the pulp of the finger.

Natural sutures may be mistaken for fissured fractures. Natural slight irregularities in the surface of some skulls may occasionally be somewhat difficult to diagnose from traumatic depressions.

Occasionally a line of subcutaneous hæmorrhage across the forehead, or a collection of blood under the hairy scalp, may be a valuable sign of fissured fracture. But care must be taken in such cases to be sure that the blood extravasation is not due merely to injury to the soft parts outside the skull.

Fracture of the **base** of the skull is diagnosed by one or more of three groups of symptoms.

(*a*) **The symptoms of severe injury to the brain.**—Thus, a patient who has been concussed, and who remains unconscious for many days, is almost certain to have sustained a fracture of some part of the base of the skull, even though no definite signs of fracture have manifested themselves. Rapidly deepening compression, indicating intracranial hæmorrhage, is also in itself strongly suggestive of fracture.

(*b*) **The escape of blood, or cerebro-spinal fluid** (and very rarely of brain substance) through the fracture.

Every fracture causes a certain amount of hæmorrhage from the vessels in the bone, or from those lying in close contact with it. This bleeding may take place on the inner surface of the fractured bone, in which case symptoms of intracranial pressure or irritation will ensue.

Or, the blood may pass outwards and collect under the soft tissues which cover the bone. Thus, a fracture of the posterior fossa often leads to the formation of a deeply-seated hæmatoma behind the ear and at the upper part of the neck. If it is quite clear that such a hæmatoma is not due to a direct blow upon these soft parts, then it becomes a most important sign of fracture of the posterior fossa.

Similarly, blood extravasated from a fracture at the anterior part of the base of the skull makes its way into one or both orbits, and causes the well-known discoloration of the eyelids and subconjunctival tissues.

Or, the blood may pass to the surface of the body and become visible externally.

This occurs when the fracture traverses a cavity such as the middle ear, and is attended by rupture of the soft parts covering the bone (*e.g.*, the membrana tympani).

As a very large number of fractures of the base of the skull do involve the petrous bone and so the middle ear, **bleeding from the ear** becomes a very important sign of fracture of the base.

Before accepting bleeding from the ear as a sign of fractured base, it must be ascertained that the blood has not merely run into the ear as the result of some comparatively trivial wound of the external ear or meatus.

It is also possible for a rupture of the membrana tympani to cause a minute hæmorrhage, and a pre-existing polypus or other disease of the ear may do the same thing.

Bleeding from the nose is also a common sign of fracture of the anterior part of the base. But bleeding from the nose is so common as the result of direct blow upon the organ that much caution has to be exercised before it can be accepted as a positive sign of fracture of the anterior fossa.

Sometimes the blood from a fracture of the anterior part of the base makes its way into the pharynx and thence to the stomach, revealing its presence only when vomiting sets in.

Cerebro-spinal fluid may escape through a fracture whenever there has also been a rent in the dura mater. When cerebro-spinal fluid escapes into the tissues it is rarely of much importance as a diagnostic sign, because it is not easily recognised as such. But when it escapes on to the surface through the ear it affords a sign of the utmost value. A discharge of a quantity of clear watery fluid from the ear, coming on shortly after an injury to the head and persisting for many hours or days, is pathognomonic of fracture of the base involving the petrous bone.

It can be confused with nothing else, since the fluid from the middle ear is too small in quantity, and the fluid from a chronic catarrh of the ear is too viscid and turbid, to permit of their being mistaken for the clear, watery, cerebro-spinal fluid which runs away in considerable quantity.

(*c*) **Symptoms caused by injury to cranial nerves.**—Since these nerves pass through foramina in

the base of the skull it is not unlikely that one or more of them will be damaged by fracture of the base. Especially important in this respect is the **facial nerve**, which, on account of its long course within the petrous bone, is very liable to be paralysed by a fracture traversing that bone.

The delicate little nerves which supply the muscles of the orbit (3rd, 4th, and 6th) are also very likely to be compressed and paralysed by the pressure of extravasated blood.

The hypoglossal nerve, too, is sometimes damaged in cases of fracture of the posterior fossa.

The other cranial nerves are seldom involved in fracture of the base in such a manner as to give rise to diagnostic signs of importance.

CHAPTER XXX.

INJURIES TO THE NECK.

In investigating a case of injury to the neck (excluding the cervical spine, which is dealt with in the chapter on injuries of the spine) the chief points to which attention should be directed are :

1. Whether the main vessels or nerves have been injured.
2. Whether any mucous cavity (pharynx, œsophagus, larynx, or trachea) has been opened.
3. Whether the cellular tissue at the deeper parts of the neck has been opened up, and, if so, whether it has become infected, either from without, or from within, from one of the mucous cavities.

1. Injury to main vessels and nerves rarely occurs except in cases of external wound (cut throat), and in such cases the diagnosis of the parts wounded depends upon the position, depth, extent, and direction of the wound as regards the various anatomical structures in the neck. The examination of the pulsation in the artery beyond the wounded part and of the muscles supplied by the nerves, may afford some help in the diagnosis of a wound of these parts.

With regard to arterial hæmorrhage, it is well to remember that, except in cases that are very rapidly

fatal, severe hæmorrhage seldom comes from the main carotid arteries, but rather from the numerous branches of the external carotid.

2. The opening of a mucous cavity is serious because it is likely to cause infection of the cellular tissue in the neighbourhood of that cavity. If the cavity be the larynx or trachea, air is likely to be forced out into the tissues, and surgical emphysema thus be produced.

Especially dangerous on this account is a rupture of the trachea without external wound. Dangerous for the same reason are wounds of the air passages with very small external wounds.

Injuries to the larynx, whether wounds or contusions, are dangerous on account of their liability to cause serious narrowing of this already narrow part of the respiratory tract. Such narrowing may be due to inflammatory œdema, to submucous hæmorrhage, or to actual blocking of the rima glottidis by means of a detached or partially detached piece of mucous membrane, cartilage, or other portion of the larynx.

In any case then of injury to the neck some attention should be directed to the breathing, and it should not be forgotten that after an injury to the larynx severe or even fatal difficulty in breathing may set in very rapidly from any of the above-mentioned causes.

3. The danger of a septic inflammation of the cellular tissue at the root of the neck is well known. Upon the diagnosis of the septic or non-septic nature of the wound must necessarily depend very largely the question of treatment. If there is any serious doubt about the matter it is best to treat the wound as a septic one, by keeping it as open as possible. Thus are best avoided the serious and often very insidious

complications due to the spread of septic inflammation to the mediastinum, pleura or pericardium.

Injuries of the hyoid bone and larynx are to be diagnosed by the history, by local tenderness, and perhaps signs of bruising, by the loss of normal resistance or palpation if fracture have occurred, and by the hoarseness and dyspnœa which will probably be present. Laryngoscopic examination will show bruising or inflammatory swelling. It must be borne in mind that injury to these parts may cause very rapid swelling of the submucous tissues about the larynx (from ecchymosis or inflammation), and that this may easily lead to suffocation if the surgeon be not ready promptly to perform tracheotomy or intubation.

CHAPTER XXXI.

INJURIES TO THE CHEST.

In examining any case of injury to the chest the first point to be ascertained is whether the injury is one which is confined wholly to the chest wall, or whether the thoracic viscera are also implicated. The seriousness of an injury to the chest depends almost entirely upon the extent to which the viscera have been damaged.

Injuries limited to the Chest Wall.

Fractures of **ribs** are detected by placing the hand flat upon various parts of the chest and directing the patient to draw a deep breath; the movement of the broken ends upon each other may cause a sudden sharp pain; or a click may be felt or heard by the patient or by the examining surgeon. Gentle pressure with one finger at various points along the course of each rib may reveal a diminution of the normal elasticity and resistance of the rib, thus indicating fracture. Or crepitus may be thus elicited. Or irregularity of the bone may be detected by drawing the finger gently along the course of each rib in succession.

Fracture of a rib is most likely to be overlooked when

it occurs far back near the angle, where the bone is more covered with muscle, scapula, or other superficial structures.

Care must be taken that the ends of the broken rib be not pressed backward into the lung, causing further damage to that organ.

The use of X-rays in the detection of fractures of rib is obvious.

Fracture of the **sternum** is usually easily detected by the history of injury to that part, by the irregularity of the fractured bone, and by the diminished resistance to pressure exerted upon it by a finger.

Wounds limited to the chest wall are of importance only if a large artery, such as an intercostal or a branch of the axillary, has been wounded, or if the wound be septic. An incised or punctured wound of an intercostal artery occurs, however, but very rarely without wound of the pleura as well. In the latter case the bleeding will probably take place into the cavity of the thorax, and care must be taken not to overlook it.

Injuries involving Thoracic Contents.

In investigating the nature and extent of a supposed injury to the contents of the thorax, the diagnosis has to be made mainly by careful physical examination. The examination must be made by inspection, palpation, percussion, and auscultation. Just as much care and skill are required in the examination of an injured thorax by a surgeon as in the examination of a diseased chest by a physician. The surgeon, however, who is usually less well versed in the arts of medicine,

will often do well to avail himself, if it be possible, of the help of a physician in such cases.

It should not be forgotten that the injured chest may also be a diseased chest, and the signs and symptoms of injury may be much complicated by those of the pre-existing disease.

A little attention to the earlier history of the case will usually prevent any mistake in this direction.

The general appearance of the patient may afford some help in the diagnosis of a severe internal injury.

Thus a wound of the heart or pericardium almost always produces considerable, although perhaps only transient, collapse. Any injury which suddenly prevents a lung from performing its proper function produces more or less dyspnœa.

The difficulty in breathing produced by injury to the lung must be distinguished from that due to injury to the thoracic wall. In the latter case the breathing may be difficult simply because it is painful. In the case of a severe injury to the lung itself there is difficulty in filling the lungs properly with air. The breathing tends to be quickened, and cyanosis is likely to be present as well.

Inspection.—Any external mark of injury, such as a bruise or a wound, may afford some indication as to the seat of the injury.

In most cases, however, the external marks of injury are of but little help in the diagnosis of an internal injury. A most severe or even fatal injury to the lungs, heart, or great vessels may occur without any sign of external injury. Such injuries may even occur in cases of crush, without any fracture of the ribs; but only in young children, in whom the thoracic

wall is soft and yielding. A large external wound may indicate at once that the viscera have been wounded. The viscera may be actually exposed, or air may be seen to pass in and out of the wound with each act of respiration.

Such cases present less difficulty in diagnosis than those in which the external injury is very small or even apparently trivial. Punctured wounds, such as those from a needle or a penknife, may present a hardly noticeable external wound, and yet may be connected with a most serious wound of the heart.

Inquiry as to the direction and depth of the wound, and the nature of the instrument with which it was made, may afford help in the diagnosis.

Impaired movement of the chest wall may be due merely to the pain produced by a bruise or by a broken rib, but is more often indicative of a visceral lesion.

A bulging of the chest wall on one side may indicate an extreme degree of pneumothorax.

Palpation.—A subcutaneous crackling (surgical emphysema) indicates a wound of the lung in all cases except those very rare ones in which air has entered the subcutaneous tissue through an external wound. In the latter case the emphysema is never more than slight and limited to the immediate neighbourhood of the wound.

The loss of resistance in the chest wall due to fractured ribs is easily detected by palpation.

A shifting of the position of the heart due to the collapse of a lung or to great distension of the pleura with air, as in some cases of pneumothorax, may be detected by palpation of the apex beat, but is better indicated by percussion of the area of cardiac dulness.

Percussion is of great value in the diagnosis of injury to the thoracic viscera. The shifting of the area of cardiac dulness to one or other side in cases of collapse of one lung and pneumothorax has already been mentioned. Extension of the area of cardiac dulness occurs in wound of the heart or great vessels within the pericardium, and is due to the accumulation of blood within that cavity. Taken together with feebleness of pulse and inability to hear the heart sounds properly, it is a very valuable sign of wound of the heart.

But if the pericardium has been freely opened into the pleura the blood will escape into that cavity, and the pericardium does not become distended.

Of the value of percussion in the detection of fluid (blood) in the pleural cavity, but little need be said. The signs of fluid in the pleura are too well known to need repetition here. Air in the pleura (pneumothorax) gives a hyper-resonant note, and is usually accompanied by some displacement of the heart, especially if the air accumulate under pressure.

A pneumothorax is closely simulated by a diaphragmatic hernia through a rent in the diaphragm. Such an injury to the diaphragm is usually accompanied by fracture of many of the lower ribs. The physical signs produced by the presence of the distended stomach and colon within the pleural cavity are almost identical with those of pneumothorax. The distinguishing feature is the hollowness of the abdomen, which in a case of diaphragmatic hernia has thus lost some of its contents.

Auscultation of the thorax in cases of injury may be useful in the detection of friction in the pleura or

pericardium, caused by the presence of blood or, later, by inflammatory roughening of the serous membrane.

It may be useful in detecting the presence of blood within the lung in cases of local laceration or bruising; the blood causes a râle.

Auscultation is of most use, however, in showing that the normal respiratory murmur is absent from certain parts. This may be due to the presence of blood in the pleura or, later, of serous effusion.

An alteration in the normal vesicular murmur may indicate solidification of the lung from bruising or from inflammatory consolidation. Finally, pneumothorax causes absence of normal breath sounds over the affected portion of the pleura, and of more importance still are the metallic tinkling, amphoric and splashing sounds which are met with in large cavities containing air or air and fluid together.

In conclusion, a few words may be said about **hæmoptysis** as a sign of injury to the lung.

Hæmoptysis is a common sign of injury to the lung, but it is by no means necessarily present in every case. It may occur in cases of slight bruising of the lung, such as often occurs in connection with fracture of the ribs. It does not necessarily mean penetration of the lung by the broken rib.

Hæmoptysis is not necessarily present even in the most severe cases of injury to the lung. In cases of extensive crush of the root of the lung hæmoptysis may be conspicuous by its absence. In children especially, hæmoptysis is less common as the result of injury to the lungs than it is in adults.

In incised wounds of the lungs, as might be expected, hæmoptysis is usually a prominent feature.

CHAPTER XXXII.

INJURIES TO THE ABDOMEN.

When a surgeon is called upon to investigate a case of injury to the abdomen his first thought should be of the viscera. He should endeavour by all means in his power to ascertain whether any of them have been damaged, and if so, which of them, and to what extent, and in what manner.

He must bear in mind too that more than one organ may have been damaged. He will also do well not to forget to inquire into the previous history of the various viscera, and to ask himself whether any of the symptoms that are present may not be due to pre-existing disease. Sometimes when the symptoms are more severe than the trivial nature of the injury seems to warrant, he will be wise to consider whether they are not due to the lighting up of some previous quiescent disease rather than to the injury alone. Thus a very slight blow upon the right iliac fossa may start an acute attack of appendicitis. A tap upon an enlarged malarious spleen may cause very severe internal hæmorrhage. A blow upon a chronic intra-peritoneal abscess or cyst may lead to its rupture, and so on.

Injuries confined to the abdominal wall are rarely

serious, and their consideration need not detain us long. The abdominal wall may be contused or wounded. In the latter case it is possible that an artery of considerable size, such as the epigastric or internal mammary, may have been wounded. The situation of the wound and the amount of hæmorrhage, either external or into the muscular layers, will generally indicate the nature of the lesion.

In a doubtful case it may be desirable to open up the wound, and thus to ascertain more fully the exact extent and nature of the injury. Wounds limited to the abdominal wall do not produce any marked effect upon the general aspect of the patient or upon his pulse.

A wound of the abdominal wall may open the peritoneal cavity and yet not inflict any damage upon the abdominal viscera. The wound may be sufficiently large to show at once that this cavity has been opened. Or examination with a finger or probe may show clearly that such is the case. In most cases of punctured wound there is, however, at first no definite evidence whether the peritoneal cavity has been opened or not. In such a case it is usually advisable to enlarge the wound, and ascertain definitely as soon as possible whether any visceral lesion has occurred. If there is definite evidence that the peritoneal cavity has been opened, such as that afforded by the escape of peritoneal fluid or of omentum, then such an exploratory operation is all the more needful.

Cases in which there is an external wound, present as a rule, less difficulty in diagnosis than those in which there is no such wound, and we may therefore pass at once to the consideration of those more common

and more difficult cases in which the abdomen has received an injury which has not caused any external wound.

In the great majority of cases of injury to the abdominal viscera, the injury has been caused by a direct blow upon the abdomen or by the abdomen having been squeezed, as by the passage of a wheel across it. In a small minority of cases a viscus has been ruptured or displaced by a fall without a direct blow having been inflicted on the exterior of the abdomen. Such are certain rare cases of laceration or displacement of large solid organs, notably the liver and spleen.

Evidence as to the existence of an injury to an abdominal viscus is obtained in the following manner:

1. Evidence from the History of the Accident.

The patient, or those who may have witnessed the accident, should be carefully questioned as to the exact manner in which the injury was inflicted, the position in which the patient was at the moment of the accident, and, if possible, the exact part of the abdomen upon which the injury was inflicted.

2. Examination of the Patient's Clothing and of the Surface of the Abdomen.

In the case of a wheel having passed across the abdomen, examination of the clothing may indicate by the mud stains the precise point across which the wheel passed.

Examination of the surface of the abdomen in such a case, or in the case of a direct blow such as that inflicted by the kick of a horse or the pole of a waggon, may afford valuable evidence of the precise situation of the injury by revealing a bruise or slight laceration of the skin.

It must be carefully borne in mind, however, that the most severe internal injuries may have been, and as a matter of fact often are, inflicted without leaving the slightest mark upon the external surface of the body.

The absence of external marks of injury does not warrant the conclusion that the viscera have escaped injury.

3. Examination of the general Condition of the Patient.

In many cases it is at once obvious from the aspect of the patient's face that he has sustained a severe internal injury. The pinched, drawn aspect of the features may be very characteristic. Collapse is an important, but by no means necessary, accompaniment of a severe internal injury. Mere pallor of the face and feebleness of the pulse, although suggestive of a serious lesion, may be due entirely to fright caused by the accident.

4. Examination of the Abdomen.

External marks of injury have already been mentioned.

Local tenderness is important. Superficial tenderness indicates injury to the abdominal wall. Deep-

seated tenderness is more characteristic of an internal injury.

Fracture of the lower ribs indicates that these have probably been driven inwards and backwards towards the spine, and are suggestive of crush of the liver or spleen. Similarly, fracture of the pelvis, caused by the passage of a wheel across this part, is suggestive of an injury to the intestines lying in the iliac fossa, or to the common or external iliac vessels.

Rigidity of the abdominal muscles is a very important sign of injury to the subjacent viscera. Serious lesions of viscera rarely occur without this sign; and its existence together with local pain and tenderness are usually sufficient, even in the absence of other evidence, to warrant an exploratory abdominal section.

Injury inflicted upon the centre of the abdomen is usually more serious than that upon the upper or lower parts; in these parts the underlying viscera are more likely to have been protected by the ribs or pelvis.

Injury to the unprotected part of the abdomen is likely to cause crushing of the intestine by jamming it against the hard and projecting lumbar spine. Those portions of the intestine which are least able to slip freely to one side are those most liable to injury. Thus the fixed portion of the duodenum is the part of the intestine that is most liable to rupture. Similarly the lower end of the ileum, with its very short mesentery, is more likely to be torn than the other parts of the small intestines, whose longer mesentery permits greater freedom of movement.

Severe pain at or near the seat of injury is very suggestive of irritation of the peritoneum, from the

escape of the acrid contents of the intestine or possibly stomach.

A pain which was originally felt only at the seat of injury, and which rapidly spreads to a lower part of the abdomen, is strongly suggestive of the escape of visceral contents and their movement downwards by the force of gravity.

A carter was struck in the epigastrium by the pole of a waggon. When seen five hours later a slight bruise marked the exact position of the blow. The pain, which had at first been in the epigastrium, was now felt chiefly in the lower abdomen. The rectus muscles were very rigid. The abdomen was, on these grounds, immediately opened, and an extensive rupture of the second portion of the duodenum was discovered.

Distension of the abdomen is a common, but generally late, sign of severe abdominal injury. It is usually a sign of very grave import, suggesting a rupture of some hollow viscus, and consequent peritonitis. But not necessarily so. It may be due merely to bruising of the intestines.

The detection of **free gas and free liquid** in the peritoneal cavity is naturally of much importance. Free gas is best detected by careful examination of the liver dulness.

Free liquid means either the escape of the liquid contents of the stomach (very rare) or of the bladder (seldom in quantity sufficiently large to cause dulness on percussion); or it means blood (very common); or it is due to the effusion of serous fluid poured out from the peritoneum. In the latter case the fluid appears later and is due to inflammatory changes. Frequently

the fluid found in the abdomen some hours, or a day or two, after the accident is a mixture of blood and serous fluid. That the liquid is free is shown by the usual test of alteration of the dulness with the altered position of the patient.

Fluid poured out into the retro-peritoneal cellular tissue may also come forwards into the flanks and give rise to dulness, but in this case the area of dulness does not vary with the position of the patient. Retro-peritoneal collections of fluid are at first either blood (derived either from the kidney or occasionally from the great vessels of the abdomen lying behind the peritoneum), or else urine derived from the kidney or ureter. In later stages inflammatory fluids (pus) may be the cause of dulness.

5. Evidence from Excreta and Ejecta.

Vomiting is common in all forms of abdominal injury, and does not help much in the differential diagnosis of the part injured. Vomiting of blood may point to a laceration of the mucous membrane of the stomach, but is not common. Severe ruptures of the stomach are not usually attended with the vomiting of blood in any quantity.

The presence of **blood in the motions** (melæna) may similarly point to a lesion of the intestine. But in recent injuries of the intestines blood is rarely passed by the bowel, and is of but little importance in the diagnosis. At a later stage, some days after the injury, it is not uncommon for the motions to contain dark, tarry material (altered blood), which points to an intestinal contusion.

Hæmaturia is extremely common as the result of an injury to the kidney, and is the most valuable sign of such an injury. Indeed, in every case of abdominal injury a careful examination of the urine should be made.

Rupture of the kidney is on this account more easy to diagnose with certainty than that of any other abdominal viscus.

6. **Exploratory Operation.**

In many, perhaps in most, cases of severe abdominal injury without external wound, it is quite impossible at first to make any certain diagnosis. From the nature and situation of the injury we may suspect that such and such a viscus has been wounded. But the absolute proof is rarely forthcoming at the time at which the diagnosis ought to be made, if any operative treatment is to be undertaken with a reasonable prospect of success. Early diagnosis is all important in those cases in which operation affords the only chance of recovery.

In order to make a really early diagnosis we must either depend upon general considerations such as the nature and situation of the injury, or we must watch very carefully to observe the first beginnings of the definite and really serious symptoms due to the injury itself. The symptoms caused by a severe abdominal lesion are mainly those of **hæmorrhage** and those of **septic absorption.** Injuries to the solid organs such as the liver and spleen, and to the large vessels of the abdomen, cause hæmorrhage. Injuries to the hollow viscera, such as the stomach and intestines, cause sepsis.

Pallor, smallness and quickness of pulse, and fluid in the peritoneal cavity are the signs indicating hæmorrhage. A steadily rising pulse rate without other evidence of hæmorrhage is the most valuable early sign of septic absorption.

Increasing abdominal distension and sometimes increasing temperature are, of course, common in late stages, but are not of much use in making a really early diagnosis. If the surgeon is in doubt whether he ought to do an exploratory operation and decides to wait, he will do well to have the pulse, temperature and respiration recorded every hour upon a chart, for the first twenty-four hours at least. The circumference of the abdomen should also be measured from time to time to detect increasing distension.

Exploratory operation should be undertaken—

(1) If the history of the accident and the rigidity of the abdominal muscles are such as to make it clear that a severe injury has been inflicted upon the abdomen, even if there are as yet no definite symptoms of either hæmorrhage or sepsis. A typical example would be a severe kick from a horse in the centre of the abdomen.

(2) If the signs and symptoms indicate that serious intra-abdominal hæmorrhage is going on.

(3) If the rising pulse-rate and other symptoms indicate that septic absorption is beginning, that is, that a hollow viscus has been penetrated (generally the intestine).

The surgeon must also be guided by the age of the patient and the nature of the abdomen upon which he proposes to operate. An operation upon a fat or distended abdomen is far more serious than an operation upon one in which these conditions are not present.

It must be remembered also that an exploratory operation in itself necessarily does harm, and that it is of no use unless it can be immediately followed up by a proceeding intended as a curative measure. The good that can be done by an operation for abdominal injury is practically narrowed down to (1) the arrest of hæmorrhage by tying vessels, or by plugging with gauze; (2) the closure of a wound of a hollow viscus by sewing it up, and thus preventing further extravasation of septic material; (3) removal of any septic material that has already been extravasated.

An operation that does none of these three things does more harm than good.

CHAPTER XXXIII.

INJURIES TO THE PELVIS.

Injury to the pelvis may involve fracture of the bones with or without damage to the viscera. Or the viscera alone may be damaged by direct wound or by rupture.

In examining for fracture of the pelvis it is best to press the ossa innominata together; this will show a characteristic looseness in most cases of fracture. Or pressure from before backwards upon one anterior superior spine will show the same thing. Crepitus may be obtained also by either of these methods, but is by no means essential for the diagnosis.

Fractures breaking off the crest of the ilium are usually very easily detected by the great looseness of the detached fragment.

The commonest fracture of the pelvis is one which passes through the obturator foramen in front, and through or near the sacro-iliac joint behind.

This form is best detected by carefully passing the finger along the crest and horizontal ramus of the pubis and along the margin of the pubic arch. In both these places the bones are comparatively superficial and easily examined. As a fracture of the pelvis almost always traverses one or other or both of them, it can usually

be very easily detected. In a doubtful case much help may be obtained by passing a finger into the rectum or vagina, and examining the pelvis from within.

X-rays are of comparatively little practical value in the detection of fractures of the pelvis on account of the difficulty of applying them to this bulky region of the body.

In every case of injury to the pelvis or its neighbourhood the **condition of the viscera** should be considered.

The **bladder** is likely to be ruptured if it was full at the time of the accident. If the bladder was known to have been full at the time of the accident, the patient has not passed water since, and the distended bladder cannot be felt on bimanual examination, then rupture of the bladder may be diagnosed. The diagnosis will be confirmed by passing a catheter. Probably only a small quantity of blood-stained urine will be withdrawn.

It must be remembered that the symptoms due to the escape of urine into the abdomen are at first usually by no means severe. In a doubtful case of rupture of the bladder it may be advisable to inject a measured quantity of fluid into the bladder. If the whole of this fluid cannot be withdrawn again by catheter, the inference is that some of it has passed through a rent in the bladder.

If the bladder be ruptured extraperitoneally into the cellular tissue behind the pubic bones, the diagnosis is more difficult. In a fracture of the anterior part of the pelvis, the possibility of this accident being due to a sharp fragment of bone being driven into the bladder must be borne in mind. The passage of a catheter will probably reveal the presence of blood-stained urine.

Swelling will soon make its appearance behind and above the pubic bones, due to infiltration of the cellular tissue with urine, or urine and blood. Infiltration of the same part with blood alone is common in cases of fractured pelvis, and much difficulty may be experienced in determining the nature of such a swelling. Careful observation of the pulse and temperature for a few hours will probably help in the diagnosis. Effusion of urine is more likely to affect these than is a mere effusion of blood.

In a doubtful case the parts must be explored through an incision in the middle line immediately above the pubes.

In all cases of injury to the pelvic regions, and especially to the perineum, attention should be directed to the state of the urethra.

Rupture of the **urethra** does not necessarily cause any symptoms of which the patient will complain. If there is bleeding from the urethra it is probable that attention will be called to the part. But if there is no external bleeding, it is not difficult to overlook a serious rupture of the urethra until extravasation of urine has occurred, and the gravity of the case has been greatly increased. If the surgeon's attention has been directed to the urethra, there is usually but little difficulty in making the diagnosis of rupture. Inability or difficulty in the passage of a catheter, and the presence of tenderness and perhaps swelling in the perineum, will indicate the nature of the injury. Confirmation of the diagnosis will be afforded by the operation which in most cases has to follow at once.

In the later stages of rupture of the urethra, when extravasation has set in, the symptoms are the same as

those of extravasation due to non-traumatic rupture connected with stricture of the urethra.

Wounds of the **rectum** are rarely connected with fracture of the pelvis. They are usually produced by falls upon, or blows from, sharp pointed bodies. They present but little difficulty in diagnosis, provided that a thorough examination of the wound be made.

CHAPTER XXXIV.

INJURIES TO THE SPINE.

The diagnosis of fracture-dislocation of the spine is made partly by direct physical examination of the injured part, as in the case of fractures of most other bones, but mainly by inference from the symptoms produced by the concomitant damage to the spinal cord.

In examining a case of suspected fracture of the spine, the utmost care should be taken that more harm be not done to the spinal cord by causing further displacement of the broken or dislocated portions of the spinal column.

The patient must not, of course, be allowed to make any attempt to sit up. The examination of the back must be made by passing the hand under the patient's back and carefully feeling the spine. Irregularity of the bones, a prominent angle, or a gap between the vertebræ, may show an obvious fracture. It may be permissible to roll the patient gently over on to his side for the purpose of inspection of the back, but this is seldom necessary or desirable, unless the presence of an external wound requires it.

We have to discuss the diagnosis of the injury (i) to the vertebral column, (ii) to the spinal cord.

(i) The slighter **injuries to the vertebral column,** such as rupture of ligaments or muscles, or

fracture of outstanding processes of bone, may give rise to few or no definite signs of injury beyond some pain, tenderness, and stiffness of the affected part.

Even a fracture through the body of a vertebra may occur without causing any definite signs of its presence if the spinal cord have not been injured, and no displacement of bone have occurred. Care must be taken not to conclude too readily that no serious injury to the bones has occurred merely because no definite signs of such injury exist. In young people especially is it important to remember that a neglected case of slight injury to the spine often leads, a few months later, to very definite caries.

Fracture of a spinous process is usually easily diagnosed by the mobility of the broken process and by the occurrence of crepitus.

Fracture across the vertebral column without displacement and without symptoms of spinal cord mischief may often be diagnosed, not only by the pain and tenderness and loss of power of movement in the spine itself, but especially by the severe pain along the course of the spinal nerves that emanate from the injured portion of the column. A fracture which involves an intervertebral foramen is extremely likely to cause irritation of the nerve passing through that foramen, and consequently to cause pain referred to its peripheral distribution.

(ii) **Injury to the spinal cord, with or without fracture or dislocation.**

It is possible that slight and transient weakness of the lower limbs may occur with fracture of the bones owing to so-called "concussion" of the cord. Whether true concussion ever occurs without a gross lesion of

the spinal cord is, however, a doubtful and disputed point. Probably it does not. Certainly, in most of the cases of so-called mere concussion of the cord there has been an actual lesion of the cord itself from hæmorrhage or bruising.

It is possible for a spinal cord to be damaged without injury to the bones, as in the case of a stab-wound or even in a case of a fall or a blow upon the spine.

Incised wounds of the spinal cord are very rare, but when they do occur are easily diagnosed by the physiological effects produced, according to the portion of the spinal cord that has been divided.

A wound that passes near to, but does not actually involve, the spinal cord may nevertheless cause paralytic symptoms from hæmorrhage, or, at a later stage, from inflammation. The diagnosis is made partly by the fact that the effects of a direct wound appear instantly, while those caused by hæmorrhage, and which are due to gradually increasing pressure, do not supervene until after the lapse of an appreciable interval of time. Paralytic symptoms due to inflammatory changes naturally are still later in making their appearance.

The diagnosis is made also to a certain extent by the fact that the wound involves a particular spot in the cord, whereas hæmorrhage and inflammation generally affect a wider area, a great length of the spinal cord. The localisation of the seat of injury is therefore, in the latter case, not quite so accurate.

Far more common than incised wounds of the spinal cord are the **contused wounds** accompanying fracture or fracture-dislocation. The most important question that we have to determine when called to a

case of fractured spine is usually, Has the cord been completely crushed or not? If not completely crushed, has it been partly crushed, or are the nervous symptoms due entirely to hæmorrhage or other changes occurring outside the spinal cord?

If the vertebral column has been broken completely across, the delicate spinal cord seldom escapes injury. In the commonest case the cord is completely crushed opposite the seat of the fracture. At the moment of the accident the upper portion of the spinal column is usually carried forwards, so that the cord is nipped between the upper and posterior edge of the body of the vertebra below the seat of fracture, and the lamina of the vertebra above. This displacement of the bones may have been only momentary. Frequently the bones slip back again into their normal positions directly the strain upon them has been taken off. But in the meantime the cord has been nipped and crushed. In such a case of fracture-dislocation as this, the evidence of complete crush is usually only too plain; the paralysed lower limbs, the anæsthesia, the absence of deep reflexes, the zone of hyperæsthesia, and later the bladder troubles, usually form a clinical picture which is unmistakable.

An important point in the determination whether the paralysis of the lower limbs in a given case of fracture of the spine is due to complete transverse division or merely to bruising lies in the condition of the deep reflexes.

If the deep patellar reflexes are present, it may be concluded that the cord has not been completely crushed. If they are not present, no definite conclusion

either way can be drawn until some little time has been allowed to elapse. In cases of bruising without complete division of the cord, the deep reflexes may be absent for a time and then reappear.

The exact diagnosis of the seat of lesion in the cord is the more easily made when the lesion is confined to a definite and small region of the cord. If the injury is accompanied by much hæmorrhage or followed by an ascending inflammation the nerve symptoms will naturally point to a region higher than the actual seat of fracture.

Hæmorrhage around the cord, the result of injury to the vertebral column, usually takes place outside the theca vertebralis, the blood being derived from the fractured surfaces of bone and from the plexus of large veins that lines the vertebral canal.

Hæmorrhage around the spinal cord is to be diagnosed mainly by the mode of onset of the paralytic symptoms. They come on within a few hours of the accident, and gradually become more severe. If the hæmorrhage continues and is passing up the vertebral canal, then the paralysis ascends in proportion.

The symptoms of hæmorrhage are to be distinguished from those due to direct injury to the cord by their later onset. They are distinguished from those due to inflammatory changes by their earlier onset. Paralytic symptoms appearing days or weeks after the accident are not likely to be due to anything but inflammatory conditions. It must be remembered that in the adult the spinal cord does not extend lower than the first lumbar vertebra. Fractures below this level do not involve the cord itself, but only the nerves lying in the canal, but given off at a higher level.

CHAPTER XXXV.

INJURIES TO THE LIMBS.

THE diagnosis of the various injuries to the limbs is to be made in most cases by the simple and judicious application of anatomical knowledge and common sense. A bone is broken. It can no longer act as a rigid bar; movements then which depend upon the rigidity of this bar can no longer be executed. The two or more pieces into which the bone has been broken, unless impacted, can be moved upon each other. The broken fragments are more or less separated from each other; a gap exists between them which is more or less perceptible to the touch, as in common transverse fracture of the patella. Or the broken ends overlap and the bone thus appears to be shorter than it should be. One or other of the broken ends may stand out prominently and can be seen or felt. Or it can be felt on deep palpation.

The broken ends may be in contact, or can easily be brought into contact; crepitus is then produced. Crepitus must be distinguished from the grating of a neighbouring rheumatic joint, and from the creaking of inflamed or roughened synovial sheaths. Crepitus may be absent if the ends of the fragments overlap much or are separated by muscle or other soft structures.

A recent fracture is always accompanied by a certain

amount of hæmorrhage either from the broken ends of the bone or from laceration of the neighbouring soft parts. This extravasation of blood may cause considerable swelling around the fracture, and render the detection of the fracture more difficult. Sometimes this hæmorrhage is in itself evidence of fracture. Thus a large blood extravasation obscuring the patella may be taken as evidence of fracture of that bone, even when the bone itself cannot be felt, provided that it is not due to a direct blow upon the knee, and is associated with the usual history which accompanies a fracture of the patella.

Fractures extending into joints may often be diagnosed, or at least suspected, from the accompanying effusion of blood into the joint.

In the examination of a case of supposed fracture, then, a careful comparison should be made between the affected limb and the corresponding part on the opposite side of the body. The situation and relative position of the various bones and parts of the bones should be examined. Special attention should be paid to the various bony points that are most easily seen or felt. Those parts of the bone which are most easily accessible to direct examination, because less covered by muscle and other soft structure, should be carefully investigated. Thus a fracture of the surgical neck of the humerus can often be easily detected when examined from the axillary aspect, while examination through the thick deltoid muscle may fail to reveal its presence.

Separation of an epiphysis is an affection that is diagnosed chiefly by the age of the patient, by the situation in which the bone has been injured, and by

the fact that the crepitus, if obtainable, is not so distinct and clear as in the case of a fracture.

The value of examination by means of X-rays in the detection of fractures and separations of epiphyses is of course obvious.

A previous study of X-ray photographs of normal bones at various ages is useful, as it is not always easy to read X-ray photographs correctly.

Dislocations must be detected by the application of principles similar to those which guide us in the detection of fractures.

Does the end of the bone occupy its normal position? that is, does it bear its normal relation to surrounding bony points?

Can the end of the bone be felt to occupy some position other than the normal?

A correct answer to these two questions will solve the problem whether there is a dislocation or not.

If the dislocated end of the bone occupies some very deep situation beneath a mass of fat, muscle or blood extravasation, so that it cannot be plainly felt, then examination of the other parts of the bone will indicate its situation.

Careful examination of the direction of the axis of the shaft of the humerus may indicate that the head of that bone is in the axilla, rather than in the glenoid cavity. Investigation of the direction in which the internal condyle of the femur looks will indicate the position of the head and neck of that bone in a case where these structures cannot be plainly felt.

The presence of the dislocated bone in the wrong place may cause symptoms due to pressure upon soft parts. Thus the dislocated end of the humerus may

cause much pain down the arm, which may help in the diagnosis.

The movements of a joint are always more or less restricted when a dislocation has occurred at that joint.

Injuries to Joints.—Besides dislocations, joints may be affected by strains which tear the ligaments, or bruise the synovial membrane, or cause rupture of semilunar cartilages. Rupture of ligaments without dislocation is indicated by pain over the affected part; by blood extravasation more or less marked, according to the severity of the injury; and by unnatural looseness or weakness of the joint.

All injuries to joints are likely to be followed by effusion into the joint. This effusion consists of blood when it immediately follows the injury. If appearing after an interval of time it is a serous effusion, or a mixture of blood and serum.

Wounds of joints are diagnosed partly by effusion into the joint, partly by the escape of the contents of the joint (synovia), and partly by general considerations as regards the situation, direction, and depth of the wound.

Muscles may be ruptured or wounded.

Rupture of muscle is caused by violent and sudden overstrain, as when, during a fall, a patient catches with extended arm at a bar, or when a muscle is suddenly and violently put into action.

In either case the diagnosis is not difficult to make. The muscle is unable properly to perform its function, and when an attempt is made to put the muscle into action, that end of it to which the motor nerve is attached shortens and swells up, revealing a gap

between the broken ends. This gap in a case of recent rupture generally appears as a soft swelling, owing to the extravasation of blood into it. In a case of old rupture, when the blood has been absorbed and atrophy of the distal portion has occurred, the diagnosis of the condition is obvious.

Laceration or wound of the fascial sheath of a muscle may lead to hernia. In this case a well-defined soft elastic mass will be felt to project through the aperture. This mass contracts when an attempt is made to put the muscle into action.

Wounds of **tendons** demand but brief mention. Any wound in the neighbourhood of a tendon should call for careful investigation to see if the actions of the tendons can be properly executed.

In every case of injury to a limb especial attention should be paid to the condition of the main vessels and nerves.

Wounds or contusion of **arteries** are generally easily detected by the effect on the pulse below; sometimes also by the extravasation of blood that takes place at the wounded spot.

Whether a punctured wound involves a main artery or not is usually settled by a consideration of these points. It must be remembered, however, that a wound of a branch close to its origin from the main artery may cause very severe hæmorrhage and easily be mistaken for a wound of the main artery itself.

Wounds and other injuries of **nerves** are generally easily detected if care be taken to examine properly. The motor paralysis and the anæsthesia over the area supplied by the nerve are usually sufficient for the diagnosis. Cases of partial wound or temporary

damage from crushing are more difficult to diagnose. Careful examination of the exact symptoms will, however, usually suffice to obviate risk of error.

The late involvement of nerves in contracting scars generally gives rise to considerable pain and some partial motor or sensory paralysis.

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